



Livestock Agri-food Systems

CGIAR Research Program

Presented by the International Livestock Research Institute (ILRI) with :
German Development Agency (GIZ), International Center for Agricultural
Research in Dry Areas (ICARDA), International Center for Tropical Agriculture
(CIAT), International Water Management Institute (IWMI), Swedish University
of Agricultural Sciences (SLU), Wageningen University Research (WUR), World
Agroforestry Center (ICRAF)



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Annex 3.1 Partnership strategy

Selecting partners

The livestock CRP's ToC is based on impact pathways that translate research into development outcomes through the four domains (consumer demand and market systems, research capacity, production systems, and scaling), at target sites and globally as IPGs. At no stage along these pathways can the program work in isolation: it must rely on a wide range of partnerships, especially when setting its agenda and when working to ensure uptake of its research beyond the program's sphere of control, but also in conducting its research, when it must draw on expertise of key partners in specialist areas. And while the livestock-related components of the CGIAR have had strong partnerships in the domains of research capacity and production systems, more effort is clearly needed to develop analogous partnerships in the domains of consumer demand (and market systems) and scaling.

While many of the partnerships will be conventional scientific and AR4D collaborations of the kind CGIAR has successfully developed in the past, the program will explore how CGIAR Centres and Programs can contribute to the systemic change required to achieve the objectives of the SRF. It will do this by engaging in broader innovation processes that link local to global scales as described in the draft ISPC partnership study. This requires exploring and experimenting with new partnership roles and modalities. The Program has identified three main avenues for this:

- **Rationalizing the Program's role in a fast-changing landscape of scientific comparative advantage.** Science relevant to the CRP's mandate is continually evolving, with new players entering the field. This is often cited in the case of genetics in CGIAR and will apply to the CRP's genetics flagship. It also applies more widely, beyond the biological sciences (consider, for example, systems modeling). Internalizing the expertise and equipment for such science no longer makes sense. To access such capacity, innovative arrangements with advanced research institutes and the private sector are needed. These partnerships mainly fall in the categories of 'joint projects' described in the ISPC partnership study.
- **Defining catalytic roles in local value chain and systems innovation processes.** Establishing value chain teams in target countries with a longer-term agenda to research and design transformative interventions was a major feature of the Livestock and Fish CRP. Recent CRP-commissioned and external reviews of the Program endorsed the approach while recognizing that the model is still in development. This finding in part reflects the new types of partnership associated with the approach, including the Program's role in establishing and supporting national and local stakeholder platforms and forging new relationships with selected development actors. The development partnership strategy of the Livestock and Fish CRP serves as a cornerstone for this work with non-research partners. In essence, the approach adopted by the Livestock and Fish CRP will prompt the proposed Program to become a supporting and sometimes catalytic component in national innovation systems for pro-poor livestock development. Similar lessons are being assimilated from Drylands and Humidtropics livestock-related activities. These modalities relate to the 'strategic alliance' and 'collective impact' categories in the ISPC partnership study (see table below).
- **Contributing more directly to national, regional and global initiatives and innovation processes.** The Livestock and Fish CRP focused on initiating the value chain AR4D approach at its target sites (see preceding point) and less on engaging in regional and global processes. With its broader, more comprehensive mandate, the proposed Livestock CRP will contribute more directly to these processes. These efforts will build on existing engagement by core program

partners in regional and global multi-stakeholder platforms, including the FAO-led Dairy Asia, the Global Agenda for Sustainable Livestock and the EAT Stockholm Food Forum.

These three avenues or objectives will inform the Program's criteria to select strategic partners that will implement or complement the Program or with whom it will seek to align (e.g. regional initiatives). Consistent with its ToC and these three objectives, Table 3.1a lists the types of partners and engagements the Program needs to be able to deliver.

Table 3.1a. Types of partners and relevance in impact pathway and innovation systems

Type of partner	Stage and domain on impact pathway	Examples	Relevant as part of innovation systems at level of:	
			Local and national	Regional and global
National research systems	All, esp. validation	(Ethiopian) Research Institute (ET) is co-implementing community goat breeding field activities	Yes	Can be
Universities	All, esp. validation	Sokoine Univ (TZ) is hosting program office and co-leading value chain team	Yes	Can be
Advanced research institutes	Discovery and validation	Univ. of Edinburgh as part of new genomics initiative	Can be	Yes
Regional and global research networks	Discovery and scaling up	ILRI-NEPAD BeCA-Hub for biotechnology capacity building and research	Can be	Yes
Government	Validation and scaling up	Ministry of Livestock (TZ) as convenor of the Dairy Development Forum	Yes	Can be
Regional and international development agencies	Validation and scaling up	AU-IBAR as leader of control programs for <i>peste des petits ruminants</i> (PPR)	Can be	Yes
Large-scale private sector	All, esp. discovery and scaling up	DOW-Agrosciences for production and delivery of improved forage seed	Can be	Yes
Smaller-scale private sector	Validation and scaling up	Pork butchers in Masaka, Uganda for pork safety and disease control	Yes	Can be
NGOs (local and international)	Validation and scaling up	Faida MaLi, a local NGO, is supporting dairy business hubs being piloted in Tanzania	Yes	Yes
Producer organizations and other civil society	Validation and scaling up	NicaCentral is farmer cooperative delivering training of improved practices to over 1000 cattle keepers in Nicaragua	Yes	Can be
Donors	All	The Bill and Melinda Gates Foundation is actively involved in the design and support of the African Chicken and Dairy Genetic Gain projects	Yes	Yes

The categories and roles are not strict: examples can be found of almost any configuration and they are often dynamic. This table indicates where the role of each partner is expected to be especially important.

Beyond the ability to contribute to the three partnership objectives, standard principles will continue to apply in selecting strategic partners. These include:

- **Sharing a common goal** (for partners fully engaged in the program at CRP, flagship or site level); or realizing mutual benefit from complementarity (for certain collaborators, e.g. a private-sector company seeking to develop its markets).
- **Demonstrating comparative advantage** in assuring a specified role in the program.
- **Willingness to invest** to ensure the success of the program, including investment in measuring its progress (as opposed to service providers, who collaborate based on remuneration); note that this works both ways, such that the program may also need to invest, for example when it seeks to contribute to a multi-stakeholder initiative. Investment does not refer only to funding—it may involve time and other resources: for example, participating in planning and review meetings.

For the private sector it is recognized that different objectives and motivations of the private versus public sector means is required to ensure each party's objectives are **mutually compatible**, rather than necessarily having a common objective as expected with other types of partners.

When establishing a partnership with the private sector, particular attention is therefore given to explicitly identifying the motivation for the private sector involvement, which typically will refer to one of the following perceived benefits: product development (being the leader and getting edge in marketing a new product, to capture profit on new product); market development (understanding how to adapt products or services to expand their market share to new population segments, e.g. the recent interest in the 'bottom of the pyramid' markets, or an SMSE establishing its initial market); and enhancing intangibles of goodwill, brand recognition and reputation, possibly related to business-motivated CSR or to promoting sector development (e.g. meat producers group).

The specific opportunity and motivation informs the appropriate type of partnership arrangement with the private sector as service provider, research collaborator, development implementer or member of a local or international platform. Examples of how these considerations are represented among Livestock CRP private sector collaborators are presented in Annex Table 3.1c.

ILRI's Partnership Strategy and Management System (2008) distinguishes among partnerships (and the associated partners) that are institutional and those that are operational in nature. The emphasis in institutional partnerships is often on alignment of activities for complementary objectives and recognition of their role as important stakeholders. Operational partners involved in implementing program activities are considered to be: core program partners, responsible for design, management and implementation of the program; strategic research or development partners, who bring a specific capacity and limited but critical role, and will be involved in multiple activities over the course of the program; program collaborators who jointly implement very specific, often one-off project activities; and service providers, who are commissioned to implement specific activities. Also important are institutional partners, with which the program does not implement activities, but maintains and cultivates a relationship to align complementary interests and comparative advantages, such as FARA, the Forum for Agricultural Research in Africa.

Roles of partners

The types of partner outlined above play many roles which will evolve according to the needs of the research and research-into-use processes.

The choice of core program partners reflects the effort being undertaken within CGIAR to better integrate its research capacities, in this case consolidating the work of the centres with capacity relevant to livestock research, as advocated in the ISPC white paper on CGIAR livestock research. These partners also reflect the effort to link CGIAR into global innovation systems by reaching beyond the system. Core program partners are either Tier 1 or Tier 2, adopting the current CGIAR terminology for distinguishing those sharing accountability for program planning, management and implementation and participating on the CRP management committee, versus those mainly involved in joint implementation of specific activities. Each core program partner has responsibility for the research agenda in its areas of expertise:

- ILRI: Livestock research, including livestock genetics, health, feed and forages, environmental interactions, and social sciences.
- CIAT: Tropical forage research, environmental interactions, and social sciences.
- ICARDA: Small ruminant systems research, dryland forages, range management, and social sciences.
- SLU: Veterinary epidemiology, forage research, and livestock genetics as an initial focus, with the opportunity to tap into other relevant areas of expertise.
- GIZ: Research-into-use strategies, business and dissemination models for scaling up research outputs, with an initial focus on enhancing the uptake of feed and forage technologies.
- ICRAF (Tier 2): Tree-based forage technologies, environmental interactions and social sciences.
- IMWI (Tier 2): Environmental (water and soil) interactions.
- Wageningen UR (Tier 2): Livestock production systems, environmental interactions, innovation systems research as an initial focus, with the opportunity to tap **into** other relevant areas of expertise.

Having multiple sources of certain expertise is not considered duplication or competition, but rather offers the opportunity to join and reinforce capacities in these areas and create critical mass.

Other partners and partnerships will serve a range of roles to advance the program's agenda. These roles are often defined by the scope and level of activities. Working closely with national research and academic entities is critical to understand the local context and assess the appropriateness of proposed solutions in targeted sites. The Program's work on livestock health strategies with the Tigray Agricultural Research Institute in Ethiopia is a good example.

Regional partners are key to ensure our work is relevant and can be scaled up and out: in Africa, the African Union—Interafrican Bureau for Animal Resources (AU-IBAR) plays this role, especially for livestock health and genetics. Similar partnerships are required at the global level if CRP results are to influence policy and development investments more widely. Both the Livestock and CCAFS CRPs, for example, participate in the Global Research Alliance based in New Zealand, developing strategies to grow more food with reduced greenhouse gas emissions.

Strategic partners often offer a comparative advantage at a specific point along the science discovery to delivery pathway. The CTLGH is a partnership between the University of Edinburgh, Scotland's Rural College and ILRI, recently established to conduct upstream research to harness bovine and poultry adaptation and disease resistance to improve productivity in the tropics. The genetics flagship teams up with private-sector partners for services that are more efficiently outsourced, including Recombinetics for genome editing and genome sequencing companies such as Novogene. As the focus shifts from discovery to delivery of animal health technologies, the health flagship works with GALVmed and the CTTBD in Malawi, given their dedicated role in producing and

improving the live East Coast fever vaccine for use in East Africa. Continuing collaboration with the NGOs Heifer International, TechnoServe and Land O'Lakes and apex farmer organizations such as the Kenya Dairy Farmers Federation are key to validate and roll out improved dairy technologies and business models, again in East Africa. Engaging in partnership platforms such as the Dairy Asia initiative convened by FAO and the Global Agenda for Sustainable Livestock will be increasingly important in assuring the CRP's work is aligned with regional and global priorities and as a means for injecting its results and evidence into the appropriate stakeholder communities and processes.

Partnership modalities

Core program partnerships rely on the legal contracting architecture for responsibility and accountability established by the CGIAR system as expressed in Program Partnership Agreements (PPAs). Both CGIAR and non-CGIAR core program partners consequently participate in CRP management, governance and administration. Core program partners agree to bear the risk associated with the unreliability of W1/2 funding, with resources from these windows allocated to specific activities assigned according to their ability to contribute and perform. The majority of research or participation in innovation system arrangements such as multi-stakeholder initiatives will be funded through individual or joint mobilization of bilateral/W3 funding. Strategic partners and collaborators at all levels—local, national, regional and global—undertake research on behalf of or jointly with the core partners, on the basis of standard Collaborative Research Agreements (CRAs) or their equivalent when the program leads the research activity. Broader Memoranda of Understanding (MoUs) are established with strategic partners since they may contribute their own resources within the framework of a more systematic collaboration with the program. Their participation will be funded through joint mobilization of bilateral/W3 funding, which typically offers a more secure basis for managing partnerships than W1/2 funding. Depending on restrictions regarding funding over multiple years, W1/2 funding may be used to develop calls to commission research that strategic partners and other collaborators may be better positioned to do than the CRP itself. When a joint activity is led by a third party, as in the case of global multi-stakeholder platforms, the core and strategic partners and collaborators then conform to the requirements defined by the lead organization.

Another arrangement to be tested will be the systematic alignment of research activities within the program workplan but with the funding managed by the partner independent of CGIAR finances. The partner—in this case SLU or GIZ—will still be accountable for performance as per its PPA, but without fiduciary responsibilities towards the program. The funding for the activity will be recognized as contributing to the CRP, but will not appear directly in CGIAR accounts.

Strategic partnership activities

The new system portfolio and the spirit of integration that accompanies it offer new opportunities to strengthen the engagement of the program as part of the CGIAR collective in a range of strategic partnership activities. An example is coordinated support to the Africa Science and Technology agenda launched by the Forum for Agricultural Research in Africa (FARA).

However, the CGIAR System currently lacks coordination mechanisms needed to manage the balance between unilateral and collective action for such activities. The Program will monitor such efforts, exploring bilateral engagement where appropriate and pro-actively engaging in developing a joined-up approach with other CGIAR entities. As noted above, this is an area that was not given attention in the Livestock and Fish CRP, but it is now being given priority as one of the three partnership objectives under the proposed Livestock CRP. The CRP will continue to organize scientific meetings that give visibility to its wider partnerships and their results, such as special sessions at the International Grasslands Conference and Tropentag. It will also explore opportunities emerging from

CGIAR site integration efforts in the priority counties for consultation and scientific and policy events that can showcase and motivate partnerships at all levels.

Sustaining partnerships and partnering capacity

As described in the ILRI Partnership Strategy, partnerships can be nurtured by the recognition that partnership is a continuous process that requires regular attention. The Livestock CRP will follow the guidance provided in the ILRI strategy document by: (i) highlighting partnership management as a core responsibility of CRP and flagship management, and supporting this role by providing a module on partnership management training to management staff; and (ii) mainstreaming a few selected partnership management tools, notably a partnership assessment exercise and an annual partnership 'health check', as part of the Program Management Committee and flagship planning agenda. The specific investment made by the Livestock and Fish CRP in a CRP management team member dedicated to developing and managing innovative partnership arrangements with development sector actors contributed to the introduction of GIZ as a core program partner. GIZ will advise on the management of the CRP's development partnerships in the proposed Program.

Appropriate resourcing of partnerships

The Program has adopted two basic principles to guide resourcing of partnerships.

First, it will allocate W1/2 funding to support the incremental costs incurred by the core program partner in participating in the CRP. Such costs include staff time dedicated to participating in the management committee and program administration related to planning and reporting. For CGIAR partners, this cost is met as part of their indirect costs from program funding; for non-CGIAR partners, these are considered a direct cost to be funded from W1/2. Other direct costs of participation in program events such as meetings and missions on program business will be borne by the Program.

Second, aside from these types of incremental costs, core partners will be allocated W1/2 funding based their roles and deliverables agreed for implementing specific activities at Cluster of Activity level. As indicated by the composition of the CRP budget, most partnership resourcing will rely on joint resource mobilization through research funding proposals.

Table 3.1b Key strategic partnerships

A number of examples are provided to illustrate the different types of partners and partnership arrangements the CRP and flagships have established to address the principal impact pathways. They are characterized according to the change domains described in the theory of change (research capacity, consumer demand/market systems, production systems, scaling) and the level at which they occur. The types of partnerships draw from the ISPC study.

A. Livestock CRP

A.1 Multi-stakeholder platform, national, for scaling domain

Name	Rural economic development and food security donor coordination platform, Ethiopia
Convenor of the partnership and their role	Gov. of Ethiopia
Specific focus and objective	Coordination of agriculture research and development projects
Science agenda	Improved productivity, food security
Geographical focus / location	Ethiopia
Role of the CRP/FP in the partnership	Provide evidence to support partnership activities, drawn from livestock farming systems; Provide disease risk maps to inform priority setting.
Key CGIAR partner(s) and their (its) role(s)	ILRI as active partner in the platform
Key 'external' partner(s) and their (its) role(s)	
Contribution to impact pathways	Scale-up and delivery of tools and services.

A.2 Alliance (joint project), national, for scaling domain

Name	Kenya Partnership for Resilience and Economic Growth (PREG)
Convenor of the partnership and their role	USAID Kenya Mission
Specific focus and objective	The Accelerated Value Chain Development (AVCD) program seeks to apply technologies and innovations widely in selected value chains (livestock, dairy, staple root crops, drought-tolerant crops), so as to competitively and sustainably increase productivity and contribute to the goal of inclusive agricultural growth, nutrition and food security. The dairy and livestock value chains components of AVCD are mapped to the livestock CRP.
Science agenda	To test, implement and evaluate various institutional arrangements to link farmers to inputs and services and so improve livestock keepers' livelihoods and resilience.
Geographical focus / location	Northern Kenya
Role of the CRP/FP in the partnership	Contribute innovations in the area of rangeland management (Livestock and the Environment Flagship, Cluster 2) Contributes to dairy and other livestock value chain development; to test, implement and evaluate various institutional arrangements to link farmers to

	inputs and services and so improve livestock keepers' livelihoods and resilience. (Livelihoods and Agri-Food Systems Flagship, Clusters)
Key CGIAR partner(s) and their (its) role(s)	ILRI leads a project on Accelerated Livestock Value Chain Development CIP and ICRISAT implement the potatoes and drought-tolerant crops value chains programs, respectively
Key 'external' partner(s) and their (its) role(s)	USAID-funded projects on markets and accelerated growth (REGAL AG) and improving resilience (REGAL IR); USAID project on improving policy and governance (AHADI) Other Feed the Future initiatives: Financial Inclusion for Rural MicroEnterprises (FIRM), Nutrition and Health Program Plus (NPH-Plus) County governments of the targeted counties Other development partners, dairy: Heifer, TechnoServe, FIPS Other development partners, livestock: Northern Rangelands Trust, Kenya Livestock Marketing Council, University of Nairobi, Neighbours Initiative Alliance
Contribution to impact pathways	Ensure the Flagship achieves restoration of degraded lands in Kenya. Test the relationship between different institutional arrangements and household livelihoods (in particular income and human nutrition)

A.3 Multi-stakeholder platforms, global, for scaling domain

Name	Global Agenda for Sustainable Livestock
Convener	FAO
Specific focus and objective	The Agenda is a partnership of livestock sector stakeholders committed to the sector's sustainable development. It builds consensus on the path towards sustainability and catalyses coherent and collective practice change through dialogue, consultation and joint analysis. The partnership unites the forces of the public and private sectors, producers, research and academic institutions, NGOs, social movements and community-based organizations, and foundations.
Science agenda	Identify the different paths towards sustainability in the livestock sector.
Geographic focus/location	Global
Role of the CRP FP:	Provide evidence on the pathways toward sustainable livestock development, including the contribution of livestock to livelihoods and resilience. Livestock Livelihoods and Agri-Food Systems and Environment
Key CGIAR partners and their roles	ILRI participates in a number of focus areas, as well as being a member of the guiding group.
Key 'external' partners and their roles	Many, see http://www.livestockdialogue.org/partners/en
Contribution to impact pathway	Articulates mechanisms for sustainable development of the livestock sector, in the three areas of 'Global food security and health'; 'Equity and growth'; and 'Resources and climate'.
Name	Inter-agency Donor Group on Pro-poor Livestock Research and Development
Convener	The Global Donor Platform for Rural Development is a network of 38 bilateral and multilateral donors, international financing institutions, intergovernmental organizations and development agencies. Members share a common vision that agriculture and rural development are central to poverty reduction, and a conviction that sustainable and efficient development requires a coordinated global approach. There is a specific group working on the livestock sector.
Specific focus and objective	The platform endorses and works towards the common objectives of its member institutions to support the reduction of poverty in developing countries and enhance sustainable economic growth in rural areas. Its vision is to be a collective, recognized and influential voice, adding value to and reinforcing the goals of aid effectiveness in the agricultural and rural development strategies and actions of member organizations in support of partner countries.

Science agenda	Livestock-related research for development
Geographic focus/location	Global
Role of the CRP FP:	Provide evidence to guide investment choices. Livestock Livelihoods and Agri-Food Systems
Key CGIAR partners and their roles	ILRI is a member of the group.
Key 'external' partners and their roles	Various, see https://www.donorplatform.org/about/members
Contribution to impact pathway and theory of change	The group is an avenue for the CRP to influence investors, in terms of pro-poor and inclusive approaches to livestock sector development.

B. Livestock Genetics Flagship

B.1 Research consortia, international, for research capacity

Name	Functional Annotation of Animal Genomes
Convener	Iowa State University (head of Steering Committee)
Specific focus and objective	Provide high quality functional annotation of animal genomes, through standardize core assays and experimental protocols, coordination and facilitation of data sharing, establishment of an infrastructure for analysis of these data.
Science agenda	Develop and implement a strategy for functional annotation of animal genomes.
Geographic focus/location	Worldwide as breed of livestock from different parts of the world will be studied here by the consortium members.
Role of the CRP FP:	CRP Livestock Genetics Flagship: Cluster 1: assessment of resources and systems for development of strategies on AnGR utilization The flagship will contribute to new gene identification and annotation and provide tissues samples to other members of the consortium for transcriptome analysis.
Key CGIAR partners and their roles	A major CGIAR partner is the Centre for Tropical Livestock Genetics and Health (ILRI–Univ of Edinburgh–SRUC partnership). University of Edinburgh as a major consortium member will maximize our opportunities to contribute to the consortium.
Key 'external' partners and their roles	Advanced research institutes worldwide will contribute to the functional annotation of the livestock genome.
Contribution to impact pathway and theory of change	Activity embedded in Cluster 1; it will contribute to knowledge generation on livestock species (cattle, sheep, goats, pigs) functional diversity for better utilisation in improvement strategies.
Name	ADAPMap Consortium (http://www.goatadaptmap.org/)
Convener	International Goat Genome Consortium, Feed TheFuture, Nextgen and 3SR projects.
Specific focus and objective	To improve coordination among otherwise independent projects for genotyping, re-sequencing and phenotyping of goat breeds.
Science agenda	An international coordination effort for genotyping and re-sequencing projects of goat breeds.
Geographic focus/location	Africa, Europe, USA
Role of the CRP FP:	CRP Livestock Genetics Flagship Cluster 1: assessment of resources and systems for development of strategies on AnGR utilization.

	Cluster 2: Improved breeds of livestock. Provide goat genomic data to the consortium for meta-analysis of goat diversity distribution. Received from the consortium genomic data of goat reference breed for its own work.
Key CGIAR partners and their roles	ICARDA lead membership to the consortium, the International Livestock Research Institute provide samples and data.
Key 'external' partners and their roles	These are various including ARS/USDA, INRA France, Iowa State University, Virginia Polytechnic and State University, BOKU etc. None has defined roles except that they are involved in all activities of the consortium.
Contribution to impact pathway and theory of change	Knowledge sharing and technical capacity development around understanding caprine genetic diversity to enhance its sustainable utilization.

B.2 Research consortia, regional, for research capacity

Name	African Goat Improvement Program (AGIN)
Convener	United States Department of Agriculture (USDA)
Specific focus and objective	To characterize African goat population and develop breeding programs (particularly community-based breeding programs).
Science agenda	Develop a strategy for developing and deploying genomic and genetic improvement tools.
Geographic focus/location	Africa
Role of the CRP FP:	CRP Livestock Genetics Flagship Cluster 1: Assessment of resources and systems for development of strategies on AnGR utilization Cluster 2: Improved breeds of livestock Provide guidelines and successful pilot studies on the small ruminant community-based breeding improvement programs.
Key CGIAR partners and their roles	University of Natural Resources and Life Sciences (BOKU, Vienna) which has pioneered with ICARDA and ILRI the design and implementation of small ruminant community-based breeding improvement programs.
Key 'external' partners and their roles	National research systems of 12 countries in Africa; Iowa State University, BOKU etc. All are involved in all activities of the project. In particular, through its network of national partners across sub-Saharan Africa the AGIN country consortium members are providing opportunity of out-scaling the small ruminant community-based breeding improvement programs, allowing replication in other African countries.
Contribution to impact pathway and theory of change	Knowledge generation around African goat genetic diversity and enhance their performance for sustainable utilization by the poor.

C. Livestock Health Flagship

C.1 Research consortia/joint projects, international, for research capacity

Name	University of Bern, Switzerland
Convenor of the partnership and their role	Joachim Frey
Specific focus and objective	Provides microbiology and mycoplasma expertise and support in diagnostics.
Science agenda	Vaccines and diagnostics
Geographical focus / location	Global
Role of the CRP/FP in the partnership	Cluster 3. Develop diagnostics and vaccines to improve animal disease control programs. Control of mycoplasma diseases: CBPP and CCPP. Further provides support on fish health research and thus important partner in the cross-CRP work with WorldFish.
Key CGIAR partner(s) and their (its) role(s)	International Livestock Research Institute
Key 'external' partner(s) and their (its) role(s)	Advanced research institutes worldwide
Contribution to impact pathways	Knowledge generation and vaccine and diagnostics technology inputs
Name	Global African Swine fever research alliance (GARA)
Convenor of the partnership and their role	Cyril Gay
Specific focus and objective	Strengthen the links between and reduce the duplication of global research effort on foot-and-mouth disease.
Science agenda	Vaccines and diagnostics
Geographical focus / location	Global
Role of the CRP/FP in the partnership	Harmonize the FP research on AFS diagnostics and vaccines with the global research activities in the field.
Key CGIAR partner(s) and their (its) role(s)	International Livestock Research Institute
Key 'external' partner(s) and their (its) role(s)	Global coordination.
Contribution to impact pathways	Technology inputs

C.2 Research consortia, global, for research capacity

Name	STAR-IDAZ (Strategic Alliances for the Coordination of Research on the Major Infectious Diseases of Animals and Zoonoses)
Convenor of the partnership and their role	Alex Morrow
Specific focus and objective	Strengthen the links between and reduce the duplication of global research efforts, maximize the efficient use of expertise and resources and accelerate coordinated development of control methods at international level.
Science Agenda	Animal diseases, including zoonoses

Geographical focus / location	Global
Role of the CRP/FP in the partnership	Harmonize the FP research on animal diseases diagnostics and vaccines in general with the global research agenda in the field.
Key CGIAR partner(s) and their (its) role(s)	International Livestock Research Institute
Key 'external' partner(s) and their (its) role(s)	Global coordination.
Contribution to impact pathways	Technology inputs

C.3 Research consortia, national, for research capacity/production systems domain

Name	National Animal Health and Diagnostic Investigation Center, Ethiopia
Convenor of the Partnership and their role	Mesfin Sahle, Director
Specific focus and objective	Diagnostic assays and outbreak investigation in Ethiopia, capacity building in regional laboratories
Science agenda	Epidemiology: prevalence surveys
Geographical focus / location	Ethiopia
Role of the CRP/FP in the partnership	Provide disease risk maps to inform surveillance programs, supports diagnostic work in Ethiopia as co-implementer of field work. As national reference lab, NAHDIC also plays a role in capacity development of regional laboratories in order to improve veterinary services, activities which will be aligned with the CRP.
Key CGIAR partner(s) and their (its) role(s)	ILRI and ICARDA
Key 'external' partner(s) and their (its) role(s)	SLU–herd health expertise incl AMR reduction
Contribution to impact pathways	Technology inputs
Name	Makarere University and Sokoine University, Uganda and Tanzania
Convenor of the Partnership and their role	S.I. Kimera (Sokoine) and Charles Masembe and David Owiny (Makarere)
Specific focus and objective	Field studies and diagnostic assays, and evaluation of herd health interventions/packages and AMR reduction
Science agenda	Diseases/herd health
Geographical focus / location	Uganda and Tanzania
Role of the CRP/FP in the partnership	Developing disease maps, evaluating the feasibility of diagnostic tests in the field, assessing herd health interventions and developing and testing health packages for improved health and increased awareness of AMR among farmers.
Key CGIAR partner(s) and their (its) role(s)	ILRI – diagnostic testing
Key 'external' partner(s) and their (its) role(s)	SLU – herd health expertise incl AMR reduction
Contribution to impact pathways	Technology inputs and testing of herd health interventions

C.4 Joint projects, regional/global, for scaling

Name	African Union – Interafrican Bureau for Animal Resources (AU-IBAR)
Convenor of the partnership and their role	Ahmed El-Sawalhy
Specific focus and objective	Progressive control of PPR
Science agenda	Scale-up and delivery of PPR vaccine
Geographical focus / location	SSA
Role of the CRP/FP in the partnership	Develop models to improve access to animal health services and products. As science partner and regional agency AU IBAR is a key partner for supporting policy dialogue and to inform research strategy beyond the CRP.
Key CGIAR partner(s) and their (its) role(s)	ILRI
Key 'external' partner(s) and their (its) role(s)	
Contribution to impact pathways	Technology inputs and herd health management
Name	GALVmed
Convenor of the partnership and their role	Peter Jefferies
Specific focus and objective	Develop diagnostics and vaccines to improve animal disease control programs. Vaccines for control of ECF, CBPP, CCPP
Science agenda	Vaccine development and scale-up of live ITM vaccine
Geographical focus / location	SSA
Role of the CRP/FP in the partnership	Science partner for vaccine development and models for animal health products delivery, the FP will develop and do initial evaluation of delivery systems.
Key CGIAR partner(s) and their (its) role(s)	International Livestock Research Institute
Key 'external' partner(s) and their (its) role(s)	Public–private partnership
Contribution to impact pathways	Technology inputs and herd health management
Name	Centre for Ticks and Tick-borne Disease
Convenor of the partnership and their role	George Chaka
Specific focus and objective	Production of live ITM vaccine
Science agenda	Process improvement
Geographical focus / location	SSA
Role of the CRP/FP in the partnership	Cluster 3. Develop diagnostics and vaccines to improve animal disease control programs. Intellectual input and science back-stopping of production of ITM vaccine.
Key CGIAR partner(s) and their (its) role(s)	International Livestock Research Institute
Key 'external' partner(s) and their (its) role(s)	Vaccine producers
Contribution to impact pathways	Knowledge generation and technology inputs

C.5 Alliance with private sector, regional/global, for production systems/scaling

Name	Hester Biosciences Limited
Convenor of the partnership and their role	Rajiv Gandhi
Specific focus and objective	Scale-up of production of thermostabilized PPR vaccine and other potential vaccines.
Science agenda	Animal diseases, including zoonoses
Geographical focus / location	Global
Role of the CRP/FP in the partnership	Providing candidate vaccines for making them thermostable: CRP facilitating engagement of private sector.
Key CGIAR partner(s) and their (its) role(s)	International Livestock Research Institute
Key 'external' partner(s) and their (its) role(s)	Private-sector veterinary vaccine producer.
Contribution to impact pathways	Vaccine technology inputs

C.6 Multistakeholder platform, global, for production systems/consumers

Name	World Organization for Animal Health (OIE)
Convenor of the partnership and their role	
Specific focus and objective	<ul style="list-style-type: none"> ● Provision of information on international disease situation. ● Use of current scientific information on avian influenza, to develop and revise OIE's international standards and to address scientific and technical issues of prevention and control. ● Policy design, strategic research and governance in animal health and welfare. ● Capacity building and support of veterinary services, including laboratories. ● Encouragement of laboratory cooperation and communication.
Science agenda	Animal diseases, including zoonoses
Geographical focus / location	Global
Role of the CRP/FP in the partnership	Observer, balance alignment and complementarity with respect to research in the FP and thus sharpen the priorities of the FP over time in relation to world animal health agenda.
Key CGIAR partner(s) and their (its) role(s)	International Livestock Research Institute
Key 'external' partner(s) and their (its) role(s)	Global coordination.
Contribution to impact pathways	Technology inputs

D. Livestock Feeds and Forages flagship

D.1 Research platform, global, for production systems/research capacity

Name	FAO-ICARDA Cactus Network
Convenor of the partnership and their role	FAO and ICARDA
Specific focus and objective	Close yield gaps through improved feeding options, including improved cultivar and agronomic practices. The Cactus Network is an agricultural research partnership.
Science agenda	Breeding of forages with known adoption potential
Geographical focus / location	South Asia (India, Pakistan, Afghanistan) North Africa (Tunisia, Morocco), West Asia (Jordan), SSA (Ethiopia)
Role of the CRP/FP in the partnership	CRP Livestock Feed & Forages Flagship Cluster 3.2: Development of new feed and forage options
Key CGIAR partner(s) and their (its) role(s)	ICARDA has a leading role in the network; in particular for organizing the international congress (every three years), facilitating regional workshops at the request of country members, facilitating provision of plant materials, addressing specific needs through expert missions, and for maintaining the website.
Key 'external' partner(s) and their (its) role(s)	FAO and member countries: <ul style="list-style-type: none"> ● Collect and disseminate information on cactus production. ● Facilitate the collection and utilization of germplasm. ● Promote the ecological and social benefits of cactus pear.
Contribution to impact pathways	In a Mode 1 partnership: Knowledge sharing and technical capacity development around understanding genetic diversity and better use of new and existing feed resources. Cactusnet is a fast and efficient network for mobilization of knowledge and skills on utilization and management of cactus as dryland feed and multi-purpose crop from over 20 countries spread over four continents at almost no cost. It also facilitates the provision of well adapted cactus accessions aimed for forage production under different dryland agroecologies to provide access to a cheap feed resource at farm level.
Name	Livestock and Fish CRP NIRS Network
Convener	Livestock Flagship Feed and Forages
Specific focus and objective	Maintain and keep connected NIRS hubs in LAC, East and West Africa and South Asia for rapid phenotyping for food, feed, forage and fodder quality traits and exploring linkages with advanced research institutes (e.g. SLU). The NIRS Network is an agricultural research partnership.
Science agenda	Provide public and private players involved in all aspects of food and feed value chains access to rapid and affordable information about feed quality and assessing the possibility for mobile NIRS applications.
Geographic focus/location	Global
Role of the CRP FP:	CRP Livestock Feed & Forages Flagship Cluster 3.1: Tool development
Key CGIAR partners and their roles	Regional NIRS hubs are maintained by CIAT in LAC, ICARDA in North Africa and ILRI in South Asia and further capacity build. Contributing to the hubs are CIMMYT, ICRISAT, IITA and WorldFish in form of providing new crops, food and feed ingredients and new desirable traits. The platform for <i>Genetic Gain</i> will be an important partner and client.
Key 'external' partners and their roles	Crop NARES, private seed and feed sector and agro-business operators using CG hub facilities and to build their own capability supported by the CG hubs.

	Utilize and disseminate findings.
Contribution to impact pathway and theory of change	Through a Mode 1 partnership: Many crop-oriented public and private players have a need for livestock nutritional information but no infrastructure to obtain it. Also potentially available and exploitable variation in food and feed traits are underutilized because access to rapid, affordable and linked phenotyping capability is not available.
Name	Biological Nitrification Inhibition Consortium
Convenor of the partnership and their role	JIRCAS
Specific focus and objective	Development and application of Biological Nitrification Inhibition (BNI) in forages and crops. The BNI Consortium is an Agricultural Research Partnership.
Science agenda	BNI inclusion in forage breeding
Geographical focus / location	Tropics and subtropics (LAC, SE Asia, East Asia, SSA, North Africa)
Role of the CRP/FP in the partnership	Closing the yield gap, resource use efficiency
Key CGIAR partner(s) and their (its) role(s)	CIAT, ILRI, BeCA-ILRI hub — Methods for BNI measurement; CIAT — inclusion of BNI in bred lines
Key 'external' partner(s) and their (its) role(s)	JIRCAS — technology development
Contribution to ToC and impact pathways	Mode 1 type of partnership for: Discovery to scaling up

D.2 Research platform, regional, for production systems/scaling

Name	South-South Network for Forage Research in Eastern, Southern and Central Africa (FRESCA)
Convener	CIAT
Specific focus and objective	Harness the opportunities for improving forage production through South-South cooperation, sharing knowledge and expertise. The South-South Network is an agricultural innovation delivery partnership.
Science agenda	<ul style="list-style-type: none"> • Selection and development of appropriate forage varieties for various agro-ecologies and livestock production systems. • Forage integration, management and preservation techniques. • Profitable forage seed production and supply systems. • Pro-poor and gender-equitable forage value chains.
Geographic focus/location	Eastern, Southern and Central Africa
Role of the CRP FP: Cluster:	CRP Livestock Feeds and Forages Flagship
Key CGIAR partners and their roles	CIAT, ILRI
Key 'external' partners and their roles	EIAR, IIAM, KALRO, NaLIRRI, RAB, TALIRI, University of Nairobi, ICIPE, EMBRAPA, University of Alberta
Contribution to impact pathway and theory of change	Through a Mode 2 partnership: Institutional and individual capacity development; Exchange of knowledge; Influencing policy makers and investors.

D.3 Multi-stakeholder platform, national, for production systems

Name	Colombian Roundtable on Sustainable Cattle Production (Mesa de Ganadería Sostenible Colombia, MGS)
Convener	MADR, IICA, CIAT
Specific focus and objective	Multi-stakeholder platform for joint work on sustainable cattle production: <ul style="list-style-type: none"> - on public policy. - on PPP. - on research. The MGS is a national agri-food systems innovation partnership.
Science agenda	Definition of gaps that inhibit the development of sustainable cattle production in Colombia. Formulation of research projects that close such gaps.
Geographic focus/location	Colombia, exchange with other roundtables in Latin America (e.g. Mexico, Costa Rica, Brasil)
Role of the CRP FP:	CRP Livestock Feeds and Forages Flagship
Key CGIAR partners and their roles	CIAT
Key 'external' partners and their roles	MADR, MADS, Dow Agrosciences, Corpoica, GIZ, Nestlé, others
Contribution to impact pathway and theory of change	Mode 3 type of partnership for: Institutional and Individual Capacity Development; Exchange of knowledge; Influencing policy makers and investors

E. Livestock and the Environment Flagship

E.1 Multi-stakeholder platform, global, for production systems

Name	Global Farm Platform
Convenors of the partnership and their role	University of Bristol, Rothamstead Research, University of Western Australia
Specific focus and objective	To create and realize a vision of sustainable and responsible production of healthy food from healthy animals. To establish a global academic network to promote farm research platforms that will optimize ruminant livestock production and hence contribute to food security, sustainability and poverty alleviation.
Science agenda	To exchange knowledge, methods and data on global farm platforms for ruminant livestock among academics, through workshops, regional training sessions and international research project development. To provide international experience, outlook and knowledge to academic staff involved in the development and operation of farm research platforms for ruminant livestock production, through staff placements and exchanges.
Geographical focus / location	Global
Role of the CRP/FP in the partnership	Livestock and the environment flagship, Clusters 1 and 2

Key CGIAR partner(s) and their (its) role(s)	CIAT, ILRI
Key 'external' partner(s) and their (its) role(s)	The University of Alberta (Canada), the University of Bristol (UK), Kansas State University (USA), Kerala Veterinary and Animal Science University (India), the Instituto Nacional de Investigación Agropecuaria (INIA, Uruguay), the University of Leeds (UK), Massey University (New Zealand), Penn State University (USA), Rothamsted Research (UK), the University of Sydney (Australia), the University of Western Australia , the University of Wisconsin-Madison (USA), Zhejiang University (China)
Contribution to impact pathways	This partnership will allow flow of skills and knowledge across each farm research platform to ascertain the most efficient production system in contrasting climatic conditions. Key lessons learnt from these platforms can then inform policy makers in participating countries.

E.2 Multi-stakeholder platform, global, for scaling (policy influence)/production systems

Name	Global Research Alliance
Convenor of the partnership and their role	Secretariat based in New Zealand
Specific focus and objective	Alliance focuses on research, development and extension of technologies and practices that will help deliver ways to grow more food without increasing greenhouse gas emissions.
Science agenda	Provide evidence on how to reduce emissions from agriculture.
Geographical focus / location	Global
Role of the CRP/FP in the partnership	Environment flagship provides evidence through the alliance on emissions from developing country systems Environment flagship, Clusters 4.2 and 4.3
Key CGIAR partner(s) and their (its) role(s)	CCAFS also is a member of the GRA, with a similar role to this CRP
Key 'external' partner(s) and their (its) role(s)	The GRA convenes a livestock research group that holds annual meetings. The group has a three-point vision: <ul style="list-style-type: none"> ● Increase agricultural production with lower emissions. ● Improve global cooperation in research and technology. ● Work with farmers and partners to provide knowledge.
Contribution to impact pathways	The GRA is a global player that can disseminate the flagship's research results
Name	CGIAR Land Restoration Initiative
Convenor of the partnership and their role	CGIAR WLE Restoration of Degraded Land (RDL) Flagship
Specific focus and objective	Restoration of degraded forest and agricultural landscapes
Science agenda	IPGs for landscape restoration
Geographical focus / location	Global
Role of the CRP/FP in the partnership	RDL flagship will develop and implement an integrating framework for CGIAR and partners to prioritize preventive and restorative intervention strategies and monitor progress towards land restoration targets; it will develop IPGs on agricultural landscape restoration and facilitate CGIAR engagement in global restoration dialogues.

Key CGIAR partner(s) and their (its) role(s)	FTA CRP—providing IPGs on restoration of forest landscapes LDC CRP— providing IPGs on restoring dryland landscapes Livestock CRP—providing IPGs on livestock and environment CCAFS CRP—providing IPGs on climate change mitigation
Key ‘external’ partner(s) and their (its) role(s)	NatCAP Stanford University, WRI, GIZ These partners are internationally recognized conveners on land restoration and can provide a platform to CGIAR for presentation and discussion: Global Landscape Forum (GLF), Land Degradation Assessment of the Intergovernmental Platform on Biodiversity and Ecosystem Services (IPBES), the Convention on Biological Diversity (CBD) and its Aichi Targets, the Global Partnership on Forest Landscape Restoration (GPFLR), the Global Soil Forum, the Economics of Land Degradation Initiative (ELD), the UNCCD, the UNFCCC, and the SDGs.
Contribution to impact pathways	At the heart of this partnership are the four CGIAR CRPs that together with their partners will achieve the aspirations of CGIAR to restore degraded lands, improve land and water productivity and protect natural resources and ecosystem services. Engagement in these global dialogues will support alignment of national and local agendas with global agendas, raise awareness of the interventions needed and motivate investment in them.
Name	UN Framework Convention on Climate Change
Convenor of the partnership and their role	UNFCCC
Specific focus and objective	To bring about global commitments to managing and mitigating the impacts of global climate change.
Science agenda	Compile and provide the best evidence on climate change to countries.
Geographical focus / location	Global
Role of the CRP/FP in the partnership	The environment Flagship targets the UNFCCC COPs as a forum for highlighting the science on mitigation through livestock.
Key CGIAR partner(s) and their (its) role(s)	All
Key ‘external’ partner(s) and their (its) role(s)	
Contribution to ToC and impact pathways	Provides the CRP with a mechanism for global impact.

E.3 Multi-stakeholder platform, regional, for production systems/scaling

Name	Africa CSA Alliance
Convenor of the partnership and their role	AU-NEPAD
Specific focus and objective	Empowering six million farm households in Africa by 2021 to take up and practice CSA practices on their farms.
Science agenda	
Geographical focus / location	Africa
Role of the CRP/FP in the partnership	Livestock and the Environment flagship, Cluster 3

Key CGIAR partner(s) and their (its) role(s)	CCAFS
Key 'external' partner(s) and their (its) role(s)	CARE International, Catholic Relief Services, Concern Worldwide, Oxfam and World Vision, COMESA, ECOWAS, PAFO, FAO, FANRPAN, FARA
Contribution to impact pathways	In-country partnerships across Africa Support/design frameworks for financing CSA in Africa
Name	FAO – Near East Forestry and Range Commission
Convenor of the partnership and their role	FAO
Specific focus and objective	Sustainable management of rangelands: towards a green economy in the Near East and North Africa
Science agenda	Rangeland restoration
Geographical focus / location	Near East (19 countries) http://www.fao.org/neareast/countries/en/
Role of the CRP/FP in the partnership	Optimize natural resource use and enhance the provision of ecosystem services (environment flagship Cluster 4.2). Develop and support improved institutions and other governance mechanisms for environmental solutions (Cluster 4.3).
Key CGIAR partner(s) and their (its) role(s)	None
Key 'external' partner(s) and their (its) role(s)	FAO and member countries <ul style="list-style-type: none"> To provide a policy and technical forum for the countries of the Near East to discuss and address forest/rangeland issues on a regional basis. Drawing on regional experiences, it also provides advice to the FAO forestry/rangeland programme. To advise on the formulation of forest/rangeland policy and to review and coordinate its implementation at the regional level; to exchange information and, generally through special subsidiary bodies, advise on suitable practices and action in regard to technical and economic problems; and to make appropriate recommendations in relation to the foregoing.
Contribution to impact pathways	Provide a policy and technical forum to encourage countries to discuss and address rangeland issues on a regional basis, with a focus on restoration.

E.4 Research consortium, regional, for production systems

Name	International Rangeland Congress (IRC)
Convenor of the partnership and their role	IRC
Specific focus and objective	The IRC promotes the exchange of scientific and technical information on all aspects of rangelands: research, planning, development, management, extension, education and training.
Science agenda	Ensure that livestock continue to enhance ecosystem services necessary to sustain productivity and improve resilience to global environmental changes.
Geographical focus / location	Global, with focus on North Africa and Middle East
Role of the CRP/FP in the partnership	Optimize natural resource use and enhance the provision of ecosystem services (environment flagship, Cluster 4.2).

Key CGIAR partner(s) and their (its) role(s)	None
Key 'external' partner(s) and their (its) role(s)	<p>IRC's committee members</p> <p>The objectives of each congress are to:</p> <ul style="list-style-type: none"> • Attract 'people' from the rangeland community throughout the world. • Provide a program that is innovative and challenges values and paradigms. • Make participants reflect on how they think about rangelands. • Offer high-quality communications. • Provide a positive and interactive environment for: <ul style="list-style-type: none"> ○ multidisciplinary participants; and ○ a wide range of land uses.
Contribution to impact pathways	Knowledge sharing and technical capacity development around understanding rangeland x animal interactions. Providing leadership for the stewardship of rangelands based on sound ecological principles
Name	International Land Coalition (www.landcoalition.org)
Convenor of the partnership and their role	IFAD
Specific focus and objective	Committed to help its members realize people-centred land governance
Science agenda	n/a
Geographical focus / location	Global South
Role of the CRP/FP in the partnership	(environment Flagship, Cluster 3)
Key CGIAR partner(s) and their (its) role(s)	ILRI is a member and hosts the technical advisor to the ILC Rangelands Initiative in East Africa. The initiative disseminates best practices and case studies in rangeland management.
Key 'external' partner(s) and their (its) role(s)	
Contribution to impact pathways	The ILC gives the flagship global reach in its Cluster 3 agenda, to bring about governance reform for better rangeland management.

F. Livestock Livelihoods and Agri-food Systems Flagship

F.1 Research consortium (joint project) including private sector, international, for production systems

Name	Local and International Business Collaboration for Productivity and Quality Improvement in Dairy Chains in Vietnam, Indonesia, Tanzania and Kenya (LIQUID)
Convener	A WOTRO-funded program convened by Wageningen University
Specific focus and objective	The overall objective of LIQUID is to contribute to improved food and nutrition security in Southeast Asia and East Africa by studying, sharing knowledge and building capacity on how different business models in the dairy chain provide growth opportunities for smallholders and workers, and enhance the availability and quality of dairy products for consumers. In all of the program's sub-objectives, gender and youth will receive special attention.
Science agenda	<p>The science agenda is encapsulated in the following five research objectives:</p> <ul style="list-style-type: none"> • Explore inclusive business models in Southeast Asia and scale out the best practices to East Africa.

	<ul style="list-style-type: none"> Assess how different models of vertical and horizontal business collaboration support farmers in increasing quality, quantity and productivity. Investigate how business models can help manage risk and seasonality in small-scale production systems and thereby improve productivity. Study how quality assurance systems can be adapted to fit selected business models. Investigate how different business models can support on-farm innovations towards more sustainable farming practices.
Geographic focus/location	East Africa: Kenya and Tanzania Southeast Asia: Vietnam and Indonesia
Role of the CRP FP:	Part-fund a scientist position to address research objective 3 (livelihoods flagship)
Key CGIAR partners and their roles	ILRI, focusing on objective 3
Key 'external' partners and their roles	Wageningen University: program coordination, supervision of post-doc to address objective 1, and train and supervise PhD students for objectives 2, 4 and 5 Sokoine University of Agriculture: supervise PhD student for objective 4 Egerton University: supervise PhD student for objective 5 Royal Friesland Campina: capacity development and facilitating research Agriterra: capacity development and facilitating research
Contribution to impact pathway	LIQUID will contribute through the following outcomes: <ul style="list-style-type: none"> A more enabling institutional environment and better coordination and collaboration among public and private actors. Better horizontal and vertical collaboration in dairy chains, leading to higher quality and productivity. Implementation of appropriate quality control systems, jointly by public and private actors. Implementation of appropriate techniques and practices by farmers, which increases productivity and milk quality in a sustainable way.

F.2 Research consortium, global, for production systems

Name	Agri-Benchmark: International network of agricultural economists, advisors, producers and specialists in key sectors of agricultural and horticultural value chains
Convener	A non-profit program convened by Thünen-Institut, Germany.
Specific focus and objective	<p>The overall objective of Agribenchmark is to:</p> <ul style="list-style-type: none"> Identify and understand driving forces for future trends and developments in global agriculture; Analyse the impact of changing economic, technological and political conditions on farming operations, farm structures and agricultural production; and Provide relevant information for all clients who want to strengthen their position in a global agricultural economy.
Science agenda	<ul style="list-style-type: none"> Develop methods and models for the assessment of production systems. Analyse production systems, their economics, drivers and perspectives. Develop methods for analysing environmental and animal welfare issues. Analyse livestock carbon emissions.
Geographic focus/location	Global
Role of the CRP FP:	Integrate learning from the consortium into CRP research
Key CGIAR partners and their roles	ILRI, focusing on objectives 2 and 4
Key 'external' partners and their roles	Agribenchmark leads the Efficiency cluster of activities in the Global Agenda for Sustainable Livestock platform

Contribution to impact pathway	Agribenchmark will contribute through the following outcomes: <ul style="list-style-type: none"> • Implementation of appropriate methods to assess beef/sheep production systems and environment. • Better understanding of the driving forces of beef and sheep farm types in developing countries. • Implementation of a standard technique for analysing carbon emissions from livestock production.
Name	LiveGAPS
Convener	This is a BMGF-funded initiative led by CSIRO to which ILRI and others contribute.
Specific focus and objective	The LiveGAPS initiative compiles the data and models needed to estimate gaps in livestock productivity. As part of the project LiveGAPS was charged with specifically addressing the relative lack of data to support international research and development interest and investment in the livestock sector. It is tackling these constraints by establishing an active livestock data and analytics community of practice, which will be supported by a web-based platform for the open sharing of livestock data, analytical tools, and related knowledge products. At the same time the intention is to invest in acquiring specific new datasets and tools designed to add value to, incentivize and promote participation from a broader range of livestock professionals. The intention is that the community of practice part of LiveGAPS will be taken up by a new BMGF activity from 2016, tentatively referred to as SEBI (Supporting Evidence-Based Interventions to achieve AgDev goals).
Science agenda	The science agenda focuses on the estimation of livestock yield gaps, bringing together the areas of livestock and systems mapping, herd and flock modelling, intervention analysis and foresight.
Geographic focus/location	Global, but with an initial focus in Ethiopia, India, Tanzania and Nigeria
Role of the CRP FP:	To contribute to, strengthen and participate in the community of practice. Livestock Livelihoods and Agri-Food Systems
Key CGIAR partners and their roles	ILRI (livestock and systems mapping; intervention analysis; foresight). IFPRI (foresight and modelling).
Key 'external' partners and their roles	CSIRO (coordination; herd modelling; intervention analysis; foresight); FAO (livestock and systems mapping; foresight); ULB (livestock and systems mapping; foresight); and others including CIRAD, for example.
Contribution to impact pathway	Compile and analyse evidence to guide interventions to bridge gaps in livestock productivity.

F.3 Multi-stakeholder platform, regional, for production systems/scaling

Name	East Africa Dairy Development (EADD) project
Convener	Heifer International
Specific focus and objective	<p>The East Africa Dairy Development (EADD) project is designed to boost the milk yields and incomes of small-scale farmers in Africa so they can lift their communities out of hunger and poverty. With help from a USD 25.5 million grant from the Bill & Melinda Gates Foundation, the second phase of EADD will work with more than 200,000 farmers to improve dairy production and access to markets over the next four years.</p> <p>Building on the success and lessons learned in Phase I, the vision for EADD II is to provide an additional 136,000 smallholder farm families with the opportunity to achieve financial independence and social equality.</p>
Science agenda	To assess the effectiveness and inclusiveness of the hub approach as implemented in EADD2, through the deployment of value chain assessment mechanisms at various levels, including the Producers Organisation Sustainability Assessment tool and the continuous monitoring cow productivity tool.

Geographic focus/location	Kenya, Uganda and Tanzania
Role of the CRP FP:	Provide scientific rigour in design and implementation of the project's monitoring, evaluation and learning framework; synthesis of lessons learned. Livestock Livelihoods and Agri-Food Systems
Key CGIAR partners and their roles	ILRI – lead partner on monitoring, evaluation and learning ICRAF – feed and forages, identification and dissemination
Key 'external' partners and their roles	Heifer International – lead partner TechnoServe – support to Producers Organisations structure and governance ABS TCM – support to genetics and breeding services
Contribution to impact pathway	Test the relationship between deployment of the hub approach and household livelihoods (in particular, incomes and empowerment of women).

F.4 Multi-stakeholder platform, national, for production systems/scaling

Name	Technical Committee on Livestock, Ethiopia
Convener	Ministry of Livestock Development and Fisheries
Specific focus and objective	Established in 2014, the committee's working groups on livestock production systems in the highlands and in pastoral areas are fora for knowledge exchange on among all stakeholders involved in livestock sector R4D in Ethiopia. The groups started with an inventory of projects at their target sites but the aim is to better integrate R4D initiatives with the national livestock development plan.
Science agenda	Opportunity to influence the R4D agenda and establish innovative partnerships with other stakeholders for scaling up tested interventions and packages.
Geographic focus/location	Ethiopia
Role of the CRP FP:	Derive technical and policy advice from experiences in livestock value chain transformation in Ethiopia and other countries. Livestock Livelihoods and Agri-Food Systems
Key CGIAR partners and their roles	ICARDA and ILRI are represented in the two working groups.
Key 'external' partners and their roles	All R4D stakeholders in Ethiopia, e.g. large USAID and IFAD development projects such as LMD, PRIME, PCDPIII, RUFIPII Role: knowledge sharing, agreement on site integration and links to similar initiatives
Contribution to impact pathway	Assessment of the role of innovation platforms in influencing small ruminant meat sector development in Ethiopia.
Name	Dairy Development Forum, Tanzania
Convener	Tanzania Dairy Board
Specific focus and objective	The Tanzania Dairy Development Forum was created in 2013 to bring together, and better coordinate, dairy sector actors in Tanzania. Members of the forum include input suppliers, producers and processors, as well as development partners, policy makers and researchers.
Science agenda	To assess the contribution of multi-stakeholder platforms to inclusive smallholder dairy value chain development in Tanzania.
Geographic focus/location	Tanzania
Role of the CRP FP:	Provide analytical framework. Livestock Livelihoods and Agri-Food Systems
Key CGIAR partners and their roles	ILRI, co-convener – provides evidence for topical questions from stakeholders.
Key 'external' partners and their roles	Tanzania Dairy Board, main convener Private sector: ASAS dairy; feed and equipment suppliers, dairy processors association Development partners: Heifer, Faide MaLi, representative of Min. of Livestock

	Research: ILRI, SUA, TALIRI
Contribution to impact pathway	Assess the role of MSP in influencing inclusive dairy development.
Name	Pig multi-stakeholder platform, Uganda
Convener	SNV Uganda
Specific focus and objective	Started in August 2014, the multi-stakeholder platform is one of the strategies used by Livestock and Fish CRP to improve the effectiveness of pig value chains in Uganda. The pig value chain multi-stakeholder platform is an innovation platform that provides a mechanism to enhance communication and innovation capacity among Uganda pig sector actors by improving their interactions and coordination. It will also facilitate learning and contribute to production and use of knowledge. In this case, the platform is geared to addressing major constraints in the national pig sector.
Science agenda	To assess the contribution of multi-stakeholders platforms to inclusive smallholder pig value chain development in Uganda.
Geographic focus/location	Uganda
Role of the CRP FP:	Provide analytical framework. Livestock Livelihoods and Agri-Food Systems
Key CGIAR partners and their roles	ILRI, co- convener; provides evidence in answer to topical questions from stakeholders.
Key 'external' partners and their roles	SNV and other development actors: Kampala Capital City Authority, SNV Netherlands, Volunteer Efforts for Development Concerns, Uganda Pig Organisation, Agro Empowerment Centre; district veterinary officers of selected districts Private sector: representative pig producers, farm input suppliers, feed suppliers, pig traders, pork butchers, roasters and processors, extension service providers Research: ILRI, Makerere University
Contribution to impact pathway	Assess the role of multi-stakeholder platforms in influencing inclusive pig value chain development.

Annex Table 3.1c Examples of private sector collaborators, their role and motivation

This annex provides examples of current or planned private sector collaborators for the Livestock CRP. The list is not intended to be exhaustive, but rather to represent the types of collaboration based on their role, the level at which they operate (local, national, regional, global), and the motivation for the partner's involvement. As the examples demonstrate, a private sector collaborator can range from a large multinational firm to business groups and individual entrepreneurs.

A. Contributes to discovery phase research for development

Global

Name, type of business:	Syngenta, Basel Switzerland
Role in CRP:	Developing superior dual purpose maize cultivars, with large scale market opportunities, including genotype*environment testing, registration of cultivars, feedback on demand, research investment. Scaling those dual purpose maize technologies for sustainable intensification of livestock crop systems. Commercialization through their distribution channels
Level, location:	Global: Currently in India
Motivation:	Improving their product portfolio and developing their market

B. Contributes to delivery phase research for development

Global

Name, type of business:	Hester Biosciences Ltd, India, veterinary vaccine manufacturer
Role in CRP:	Scale-up of production of thermostabilized PPR vaccine and other potential vaccines: developing commercial production process for thermostabilization, and distribution of vaccine products
Level, location:	Global, HQ in India, testing vaccine in Mali
Motivation:	Improving their product/service and developing their market

Regional

Name, type of business:	Silverlands Tanzania Ltd, private chicken breeding company
Role in CRP:	Day-old chicks and fertile eggs of tropically adapted yet productive chicken strains supplier to ACGG longitudinal study in Tanzania and Nigeria
Level, location:	Regional: Africa, esp. Tanzania and Nigeria
Their motivation:	Improving their product portfolio and developing their market -their chicken breed tested for its production, productivity and farmer preference alongside other chicken breeds under semi-scavenging system of management that opens new market opportunity in village chicken production system
Name, type of business:	Fol-hope Hatcheries Pvt Ltd, private hatchery operator
Role in CRP:	Provide hatchery service to ACGG project – Fertile eggs of SASSO -24, 000 (imported from Tanzania); Fertile eggs of Koekoek – 24, 000 (imported from Uganda); Fertile eggs of Shika Brown – 12, 000 (sourced from Nigeria).
Level, location:	Regional: West Africa, esp. Nigeria
Their motivation:	Adapting a product and getting it disseminated - As the member of the national Innovation Platform in Nigeria the company identified provision of hatchery service to the ACGG project as a new business opportunity of hatching eggs from non-

	conventional chicken breeds that are meant for the village chicken production system (semi scavenging)
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National

Name, type of business:	EXIM global, US private sector company engaged primarily in the global agri-business sector (food sales and project development). Ex-Im Global is heavily engaging in Ethiopian agri-business projects.
Role in CRP:	Private partner in PPP initiative to test business model aiming to improve access to animal services of livestock producers delivering animals to abattoir.
Level, location:	National; Ethiopia: Abergelle abattoir catchment area
Their motivation:	Improve quality of animals brought to slaughter, thus they are interested to provide incentives through improved services to livestock producers and in turn guarantee higher prices
Name, type of business:	Devenish Nutrition Ltd, UK private Company with branch in Uganda, production of specialised finished pig feed products
Role in CRP:	Testing business models (institutional innovation) that improve pig farmers access to quality pig feeds through franchising system with pig farmer collectives as franchisees
Level, location:	National
Motivation:	Developing their market in Uganda and to transform the pig sector from subsistence towards more commercial orientation
Name, type of business:	Sidai, a Kenyan company based on a franchise model which aims to deliver high-quality veterinary products and services to Kenyan livestock owners.
Role in CRP:	Distribution and delivery of East Coast fever 'ITM' vaccine and co-ordination of trials to assess the performance of vaccine batches in the field.
Level, location:	National, Kenya
Their motivation:	To improve the quality of animal health products and services and to assist veterinary professional to establish viable business operations.
Name, type of business:	Dodla Dairy, Hyderabad India
Role in CRP:	Pilot test and disseminate dairy feed technologies to smallholders
Level, location:	National; Currently in India but Dodla Dairy is establishing business interest in Ethiopia and Uganda
Motivation:	Increasing productivity of milk producing smallholders to reduce transaction costs in milk procurement

Local

Name, type of business:	Kishan Agriculture Works, Di. Gandhinagar, Gujarat
Role in CRP:	Manufacture and supply scythe choppers to dairy producers for cutting their fodder. This device was small and woman friendly and needs only one person to operate. The chopper given by government was bigger and needed two persons to operate. The company reduced the handle size based on suggestion from farmers
Level, location:	India: Currently in Gujarat, supplying the chaff cutters to Almora and Bageshwar, Uttarakhand region. An IFAD loan project (ILSP) is facilitating the availability of choppers to other districts through SHG based federations
Motivation:	Increase their sales through improvement in the models. demand based production
Name, type of business:	ASAS Dairies Ltd (Large milk processor)
Role in CRP:	Testing of business hubs. The company was attracted to collect milk from farmer groups in agro-pastoral areas whose formation was facilitated through the CRP for interventions testing. The CRP is following up on the viability of the business case in pre-commercial areas
Level, location:	Local (Morogoro); milk processor has national milk distribution network

Motivation:	Milk processor has under-utilized processing capacity against increasing demand for milk in Tanzania
Name, type of business:	Shamba Kubwa, private ranch
Role in CRP:	Source of Buffel grass splits for local farmers
Level, location:	Local, Tanzania: Morogoro area
Their motivation:	Improving ability of smallholders to feed their cattle will improve their demand for the improved cattle being bred and sold by the ranch
Name, type of business:	Milk traders (individuals and groups)
Role in CRP:	Testing of business hubs. Participating in interventions involving business linkages with producers and inputs service providers facilitated by the CRP to grow hubs for pre-commercial and commercial areas
Level, location:	Local Morogoro and Tanga
Motivation:	Opportunities to grow milk businesses through higher turnover (volume and frequency) to clients including individual consumers and processors
Name, type of business:	Dairy cooperatives
Role in CRP:	Testing of business hubs. Participating in interventions involving business linkages with producers and inputs service providers facilitated by the CRP to grow hubs for commercial areas
Level, location:	Local Tanzania region of Tanga
Motivation:	Opportunities to grow milk collection to fill the unmet demand. These cooperative supply milk locally and to Tanga Fresh (milk processor with national reach) that has underutilized capacity installation.
Name, type of business:	Local small-scale inputs and service providers for artificial insemination, feed, health, credit
Role in CRP:	Testing of business hubs. Participating in interventions involving business linkages with producers and milk traders (with milk used as collateral for credit in some cases) facilitated by the CRP to grow hubs
Level, location:	Local; Tanzania regions of Morogoro and Tanga
Motivation:	Opportunity to grow milk businesses in inputs and service provision
Name, type of business:	Wambizzi cooperative, the central pig slaughterhouse in Kampala, Uganda
Role in CRP:	Testing waste management technologies to manage slaughter waste
Level, location:	Local: Kampala, Uganda
Motivation:	Improving hygiene in the abattoir and improving quality of their product
Name, type of business:	Mukono pork traders association
Role in CRP:	Testing training interventions around appropriate pork handling practices and hygiene
Level, location:	Local: Mukono district, Uganda
Motivation:	Improving quality of their product and profit margins

C. Contributes to sectoral development

Global

Name, type of business:	International Meat Secretariat, industry association
Role in CRP:	Co-member of the Global Agenda for Sustainable Livestock, actively interacts and collaborates in developing evidence-based policy messages and initiatives
Level, location:	Global
Motivation:	Enhancing goodwill and positive image of the sector, in the interest of maintaining and improving their market

National

Name, type of business:	Tanzania Milk Processors, industry association
Role in CRP:	Co-member of the Dairy Development Forum, actively interacts and collaborates in developing evidence-based policy messages and initiatives, such as the Maziwa Zaidi (More Milk) campaign
Level, location:	National: Tanzania
Motivation:	Enhancing goodwill and positive image of the sector, in the interest of maintaining and improving their market

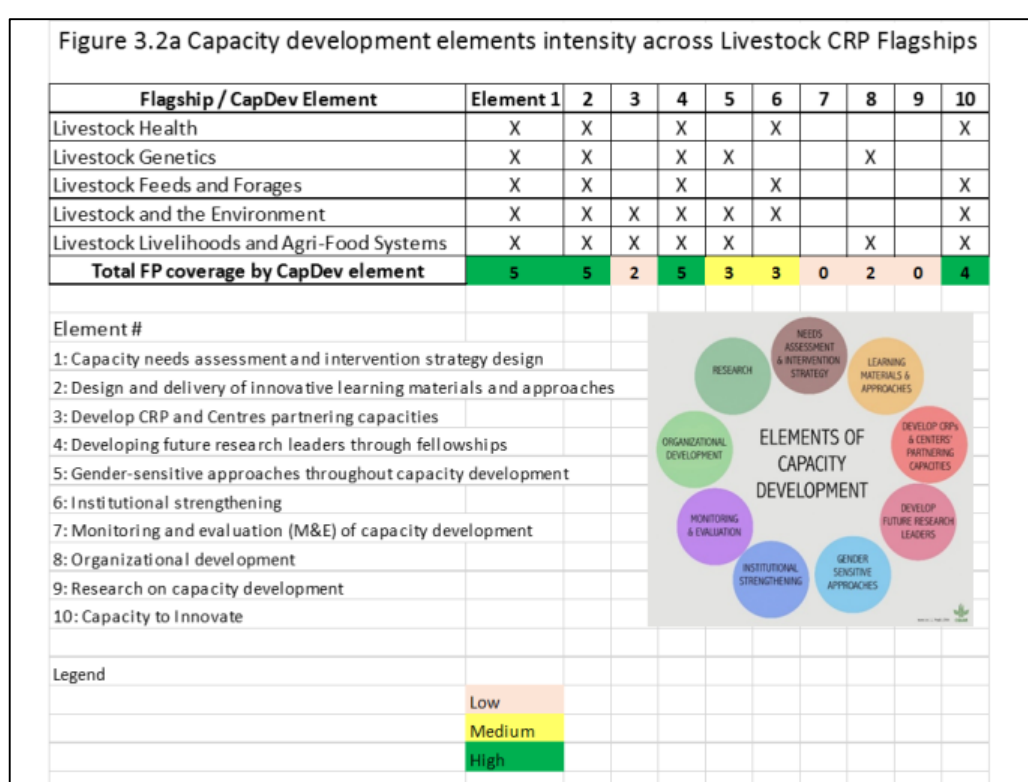
Annex 3.2 Capacity development strategy

Role in impact pathway

At the CRP level, capacity development is seen as an enabler of the impact pathway, focusing on individuals' and organizations' capacity to undertake and to use research. This will result in the enhanced ability of our research and development partners to make progress towards the IDOs and SLOs. At flagship level, analysis has been done to identify the key areas where capacity development will be needed most. This exercise has informed the strategic actions and budgets outlined below.

Strategic actions

The five flagships have identified 5 to 7 capacity development elements each that they will be focusing on. When aggregated, these give an indication of the CRP's priority areas, as can be seen in Figure 3.2a below.



In terms of specific priorities of the flagships, the following key activities have been identified.

Livestock Genetics

Capacity development of individuals, organizations and institutions to take research results to scale and ensure sustainability of genetic interventions will be based on needs assessment and involve the use of innovative learning materials and approaches that are gender sensitive.

The impact of capacity development activities will be monitored and evaluated, such that they can be adjusted if needed and can be used to derive lessons learned for sharing with others. Stakeholder groups targeted for capacity development include livestock keepers, national agricultural system partners, development partners, private-sector partners, information service providers, decision makers (including policy makers), and research partners, among others.

The flagship will also develop the capacity of future research leaders in animal genetics through graduate fellowships for research training, in collaboration with institutions within and outside the targeted countries (e.g. academic institutions), and through mentorship and on-the-job training. This will include training supported by the African Biosciences Challenge Fund (ABCF) of the Biosciences east and central Africa (Beca)-ILRI hub.

Additionally, curricula and training modules targeted at higher education programs in animal breeding, genomics and genetics for African regions will be developed, based on needs identified by the ILRI–SLU training program.

Livestock Health

Capacity development is a key component of all clusters of this flagship, each with different priorities and each addressing several elements of the CGIAR capacity development framework. There are two tracks for capacity development in the flagship, one addressing capacity to undertake research and one to use and apply research outputs, including awareness and delivery dimensions. Key elements per cluster are as follows:

In Cluster 1, we will need to develop the capacity of farmers to recognize diseases and measure their impact. In addition, research will be conducted with national partners who will require training in relevant research methods in epidemiology and impact measurement. Thus, this cluster will depend heavily on capacity development of partner institutions in both technical and social aspects in order to achieve intended outcomes.

Cluster 2 activities require substantial engagement of livestock producers and vets in the development of herd health packages. This offers exciting opportunities for R4D engagement during on-farm trials for women, men and young people, thereby fostering their capacity to innovate. Community animal health workers (CAHWs) and vets will need capacity development in how to use developed tools and packages. The key to achieving the necessary capacity will be the development of innovative learning materials and approaches based on adult learning theory combined with instructional design. All activities in this cluster also need to be gender sensitive.

Capacity development related to Cluster 3 will focus on fellowships, both as traditional MSc or PhD projects and in collaboration with Beca-ILRI Hub/ABCF Fellows. It will thus support the development of future research leaders in cutting-edge bioscience topics.

Cluster 4, which looks at delivery models for animal health products and services, depends on training for various audiences ranging from farmers, through CAHWs and vets, to policy makers. Besides the development of learning materials (printed and electronic), this cluster offers exciting possibilities for enhanced ICT4Ag work, including use of emerging technologies (e.g. Unmanned Aerial Vehicles) to deliver animal health products and services.

Livestock Feeds and Forages

Capacity development in this flagship will build on approaches developed during Phase 1 of the CRPs. It will focus primarily on two of the elements described in the CGIAR capacity development framework, namely **Design and delivery of innovative learning materials and approaches** and **Development of future research leaders** through fellowships.

Learning approaches, including blended learning for farmers and development practitioners, which is being developed for use in conjunction with decision support tools (e.g. FEAST/TechFit, SoFT), will be extended, while the efficiency and reach of these tools will be improved by using novel ICT approaches. Training of trainers will be addressed through capacity development events that focus

on selected CRP sites and by incorporating approaches such as new instructional design. Big data approaches will be brought into play to support a broad audience ranging from development, research and education institutions, to policy makers, the private sector and farmers/farmer associations. Within the CRP, we will continuously train PhD, MSc and undergraduate students, while also receiving inputs from them and their supervisors that will enrich our research and contribute strongly towards its outputs.

Livestock and the Environment

The flagship recognizes a particular need for capacity development, as the concepts and interventions for implementing environmental management of /and through livestock production systems are not yet well established in many of the CRP's target countries. So this is a priority.

A capacity needs assessment will be the starting point, and will enable the refinement of a capacity development agenda that is expected to include:

- Design of training materials and approaches for environmental impact assessment frameworks and methods developed under Cluster 1 and the interventions developed under Cluster 2. Care will be taken to develop gender-sensitive approaches.
- A range of activities designed to enable women and young people to act as agents of change. The flagship's theory of change builds on the assumption that this can work.

In addition, capacity development will be instrumental in reaching: 1) environmental managers and staff in national development agencies, enabling them to design and implement a program of activities in this new field; and 2) the national and global research community, with a view to increasing their ability to use research outputs.

In order to influence policy changes, the flagship will test different partnership models, including seconding staff to line ministries, joining consultative forums (e.g. on climate-smart agriculture), and offering fellowships or study opportunities to national partner staff.

In terms of developing future research leaders, the flagship will support a number of fellowships (Msc and PhD), some of them through the Mazingira center.

Livestock Livelihoods and Agri-Food Systems

Capacity development in this flagship will start with conducting and formulating a **Capacity needs assessment and intervention strategy** in order to determine the gaps between existing and required competencies of both research and development partners and work out ways of closing the gaps. Activities related to **Capacity to innovate** will be implemented in four clusters. For example, in Clusters 4 and 5 on understanding how change comes about in sites where new institutional arrangements will be promoted, and on applying monitoring and learning systems that embed research activity in ongoing processes of change.

Gender-sensitive approaches will be pursued in three clusters, especially in areas where the 'gender lens' has been less frequently applied, for example in the foresight work in Clusters 2, 4 and 5.

Institutional strengthening will take place in at least three clusters, including Cluster 5 in relation to facilitating and engaging in multi-stakeholder dialogues as well as in Cluster 1 with respect to development of the capacity of policy makers to use CRP research outputs.

Finally, at least two clusters will directly develop CRP and centres' **Partnering capacities**. For example, Cluster 5 will identify the most appropriate partnership models, including public-private

partnerships. At least two clusters will also work on organizational development, including Cluster 4 on supporting delivery mechanisms for rural advisory services in selected sites in priority countries.

All clusters will also engage in the more traditional capacity development activities by Developing future research leaders through fellowships and by embedding students in research activities from the start, in collaboration with universities from the priority countries and partner universities from the North.

Specific engagements within the BecA-ILRI Hub and Mazingira Centre

As mentioned above, all flagships will engage in the development of future leaders through fellowships. However, there are two specific innovative approaches that we would like to highlight in this regard, namely the African Biosciences Challenge Fund (ABCF) of the BecA-ILRI Hub, and various opportunities for fellows at the Mazingira Centre to study climate-smart agriculture.

The ABCF is a visiting scientist program targeting scientists from African national programs, who are invited to undertake biosciences research-for-development projects at the BecA-ILRI Hub, using high-end facilities and equipment. It contributes strongly to the development of bioscience capacities in national programs through activities at both an individual and an organizational level. This includes identifying where specific capacities already exist and facilitating their connection to others for shared learning, resource mobilization and other multi-country, multi-disciplinary initiatives. We estimate around US\$ 1 million of funding for ABCF-related activities in the livestock CRP in 2017.

The Mazingira Centre, the first of its kind in Africa, works on mitigating livestock's environmental footprint and establishing baseline data for GHG emissions from livestock systems in and for Africa. It provides accurate and verifiable data for both crop and livestock production practices and land-use changes. Capacity development here will include drawing MSc and PhD students from across Africa, training local technicians, and mentoring Africa's future environmental and agricultural production scientists through sabbaticals and workshops.

Budget

Capacity development investments for the CRP as a whole total USD22.625 million, amounting to 7.6% of the proposed total CRP budget; USD20.575 million of which is within flagships. This amounts to 7.8% of total flagship budgets (refer to budget narratives for further explanation, including plans to grow this through new bilateral projects). The CRP will also invest in capacity development activities using the strategic investment fund (section 1.0.11).

Figure 3.2b Budget estimates for capacity development in the Livestock CRP
(For 2017-2022, it assumes 5% growth held constant at CRP and across all FPs and sources of funding)

Year 1 - 2017	Total CRP/Flagship	of which...	CapDev W1/2	CapDev W3	CapDev Bilateral	Total CapDev	CapDev as % of total
Livestock Genetics flagship	\$ 10,549,446		\$426,064	\$321,876	\$614,404	\$ 1,362,344	12.9%
Livestock Health flagship	\$ 7,970,185		\$284,480	\$97,633	\$-	\$ 382,113	4.8%
Livestock Feeds and Forages flagship	\$ 6,598,000		\$230,167	\$90,657	\$-	\$ 320,824	4.9%
Livestock and the Environment flagship	\$ 5,305,958		\$76,438	\$277,014	\$-	\$ 353,452	6.7%
Livestock Livelihoods and Agri-food Systems flagship	\$ 8,134,718		\$ 67,416	\$ 538,694		\$ 606,111	7.5%
Sub-total Flagships	\$ 38,558,307		\$ 1,084,565	\$ 1,325,874	\$ 614,404	\$ 3,024,844	7.8%
Management & cross-cutting budget	\$ 2,408,620		\$ 48,070			\$ 48,070	2.0%
Strategic Investment Fund	\$ 2,533,074		\$ 253,307			\$ 253,307	10.0%
Total	\$ 43,500,001		\$ 1,385,943	\$ 1,325,874	\$ 614,404	\$ 3,326,221	7.6%
Entire Program - 2017 - 2022	Total CRP/Flagship	of which...	CapDev W1/2	CapDev W3	CapDev Bilateral	Total CapDev	CapDev as % of total
Livestock Genetics flagship	\$ 71,756,412		\$2,898,049	\$2,189,373	\$4,179,123	\$9,266,545	12.9%
Livestock Health flagship	\$ 54,212,502		\$1,935,005	\$664,092	\$-	\$2,599,098	4.8%
Livestock Feeds and Forages flagship	\$ 44,879,023		\$1,565,573	\$616,640	\$-	\$2,182,213	4.9%
Livestock and the Environment flagship	\$ 36,090,665		\$519,924	\$1,884,222	\$-	\$2,404,146	6.7%
Livestock Livelihoods and Agri-food Systems flagship	\$ 55,331,641		\$458,560	\$3,664,152	\$-	\$4,122,712	7.5%
Sub-total Flagships	\$ 262,270,243		\$ 7,377,111	\$ 5,854,773	\$ 7,342,830	\$ 20,574,714	7.8%
Management & cross-cutting budget	\$ 16,383,224		\$ 326,968			\$ 326,968	2.0%
Strategic Investment Fund	\$ 17,229,748		\$ 1,722,975			\$ 1,722,975	10.0%
Total	\$ 295,883,215		\$ 9,427,054	\$ 5,854,773	\$ 7,342,830	\$ 22,624,657	7.6%

Annex 3.3 Gender

Gender-informed research priority setting and delivery can contribute to inclusion and equity among the women, men and young people involved in livestock-related livelihoods. The Livestock and Fish CRP made headway in integrating gender analysis into the development of livestock-related technologies, in studying key gender-based constraints and opportunities related to livestock and animal-source food consumption, in studying gender-transformative approaches, and in enhancing the capacity for gender research of CRP partners. These efforts were guided by the Livestock and Fish CRP Gender Strategy, which is the basis for the proposed Livestock CRP's gender research and capacity development. However, it will be revised and updated at an early stage. A key challenge for the proposed program is to continue deepening and embedding gender analysis throughout its research, so that gender-responsive research and interventions become the norm. This requires institutional change and continued capacity development among gender and non-gender scientists, with partners, and in CRP management. This annex sketches how gender analysis has informed the proposed program's priorities and how gender research will be organized and implemented across the CRP—and how it will be institutionalized.

Livestock Genetics

This flagship will assess species and breed preferences in relation to gender norms, and factor in gender dimensions to genetic improvement approaches and delivery mechanisms, building on Livestock and Fish CRP findings (Marshall *et al.*, 2014; Ojango and Mora, 2015; Waithanji *et al.*, 2015). Other studies show the gendered importance of this flagship's priority species: chicken and small ruminants to women's livelihoods in Ethiopia (Zahra *et al.*, 2014); dairy for both women and men in Tanzania (Njuki and Sanginga, 2013); goats for women in Kenya (Waithanji *et al.*, 2015); and pigs for women in Uganda (Ouma *et al.*, 2014). In value chains where this research has not yet been conducted, the proposed program will systematically integrate gender into the process of selecting species and determining breed preferences. Gender dimensions will be integral to the process of genetic improvement and delivery, including: ensuring the participation of women and men livestock keepers in defining genetic improvement strategies; ensuring that the genetic technologies provided are relevant to women and men; ensuring gender-equitable access to genetic technologies and associated information; and addressing issues of control over genetic technologies (in collaboration with the livelihoods flagship). Phase 2 will also explore gender norms affecting, for example, participation in breeding initiatives, and adoption of or access to, genetic technologies—a research area that was not addressed in the Livestock and Fish CRP.

Livestock Health

Gender-integrated research in the Livestock and Fish CRP corroborated the directions in which this flagship was moving and helped identify crucial entry points to address inequalities. Thus, gender analysis is increasingly being incorporated into the evaluation of animal health needs and delivery options. Women and men may have different priorities for vaccine adoption and both vaccine adoption and the impact of diseases may be gendered, as was demonstrated in a study on the gender and socio-economic factors affecting the adoption of contagious bovine pleuropneumonia vaccine (Waithangi *et al.*, 2015). Gender implications with regard to emerging drug resistance will be further investigated in the proposed program, building on Livestock and Fish CRP studies on: the dynamic nature of gender roles and relations in pig management and implications for effective African Swine Fever protocols (Dione and Ochago 2015); and, on analysis of the gendered impacts of the infection and treatment method of immunization against East Coast fever (Kiara and Teufel, In preparation). A salient focus for gender-integrated research for this flagship lies in the new area of herd health and management, which provides opportunities for gains in equity as well as productivity. Herd health research in this flagship focuses on the human component—the management aspects of animal health. Now is our opportunity to capitalize on this focus by adopting

and developing herd health packages based on gender and social analyses, so that they respond to the preferences, opportunities and constraints of women, men and young people.

Livestock Feeds and Forages

Gender dynamics and norms affect the choice of feeds and forages—and of full-purpose crops. These preferences in turn influence what feeding practices and technologies livestock keeping households adopt. In the Livestock and Fish CRP, these gender dimensions were integrated into a key diagnostic tool for this flagship called FEAST, which underwent pilot-tests in Ethiopia and Tanzania (Lukuyu *et al.*, 2015). In the proposed program, gender dimensions will continue to be integrated into diagnostic tools for the site-specific selection of feeds and forages recognizing that women and men control different livestock species (Njuki and Sanginga, 2013), which entail different forage needs. The proposed program will discern and respond to gendered forage and feed needs by systematically adopting gender-sensitive participatory methodologies, which have proven to successfully elicit gendered preferences (Galiè, 2012). They will be included in innovation systems in three livestock CRP sites. Research on the effect of gender-specific forage systems on household food security (Galiè *et al.*, 2015), will be further pursued and we will assess gendered variety preferences as affected by labour allocation and gender norms, together with the opportunities and constraints affecting variety adoption and cultivation. Finally, gender analysis will be systematically integrated into the process from trait prioritization to seed delivery. This includes seed delivery systems and seed governance frameworks, which both affect access to and control over seed technologies at intra-household level (Kerr, 2013; Galiè, 2013). We will continue to explore the empowerment potential and limitations of inclusive seed development (Song and Vernooy, 2010; Galiè, 2013).

Livestock and the Environment

This flagship merges the environment and livestock agendas, building particularly on gender evidence from the WLE (Huyer *et al.*, 2015) and CCAFS (Twyman *et al.*, 2014) CRPs, but with a specific focus on livestock. Gender research in this flagship will explore both the gendered roles that affect the mitigating impacts of livestock production on the environment and the gendered impacts of climate change on resilience. We will draw on the growing body of [literature and evidence](#) within CGIAR on gender and climate change in agriculture. We will assess gendered relations and constraints in environmental management, seeking to ensure that women and men of all ages have access to relevant strategies that enhance the environmental sustainability of livestock systems, and to increase adoption of these strategies. The impact of environmental degradation on gender relations will be studied, building on ongoing research (Tavener and Galiè, in preparation). The flagship has a strong focus on women as target beneficiaries, but more comprehensive gender analysis is still needed. Promising issues to explore include gender-based opportunities and constraints in adopting mitigation strategies, the impact of environmental degradation on gender relations and the income generation opportunities emerging with payments for environmental services.

Livestock Livelihoods and Agri-Food Systems

This is the integrating flagship for the CRP and the home to the gender and social equity cluster of activities. As such, gender is embedded throughout its activities, which demonstrates a program-wide shift in orientation to plan, design and deliver technologies to gender-differentiated users. Systems analysis for priority setting and scaling up integrates gender as comprehensively as possible in order to inform research priorities across the CRP and support gender-responsive delivery and interventions. Commitment to gender integration in systems analysis and targeting, while based in the Livestock Livelihoods and Agri-Food Systems Flagship, illustrates heightened level of effort program-wide towards strengthening the potential to deliver gender-responsive results. This work draws on ongoing research on gender-sensitive geographical targeting (Pfeifer, 2015) and gender-

differentiated best-bet evaluation (van Wijk, 2015). Research on nutrition will look specifically at the nexus between women's empowerment and intra-household nutrition, drawing on studies undertaken through the Livestock and Fish CRP. This is a relatively new research area, which will expand. Gender research in the value chain clusters will examine how different species contribute to different and gendered pathways out of poverty, as well as examine gender dimensions of the policies, markets and institutions that affect the performance of value chains. It is here that we connect gender norms at household level with the broader social arena, where these norms are reproduced and reinforced. To explore how institutional frameworks produce and reinforce gender norms, we will continue the gender-integrated value chain research begun in the Livestock and Fish CRP, which focused on designing and implementing dairy and pig hubs (Rao *et al.*, 2015; Basu *et al.*, 2015), on hub sustainability (Baltenweck *et al.*, 2015), on innovation platforms and on the development of a methodological framework for collection and analysis of producer level sex-disaggregated value chain data (Poole *et al.*, 2015).

Operationalizing gender in the CRP agenda

The Livestock and Fish CRP saw a surge of interest gender-integrated research, particularly in its final two years, in part due to support for a coordinated set of gender-integrated research activities that strengthened the capacity of many researchers in this area. Acknowledgement that gender analysis improves the quality of technical research and its delivery was a key outcome. During preparations for this program, it became apparent that integrating gender analysis into research projects does not necessarily lead to fully embedded gender analysis informing all CRP research. Operationalising the gender strategy implies a process of institutionalization that requires a combination of program-wide and interlocking elements, as outlined below.

Gender representation in the management committee. To institutionalize gender in all aspects of the program, a Gender Coordinator will be a part of the program management committee. The Gender Coordinator's role is not to police decisions but rather to participate in making them. This embeds a gender perspective in management decision-making processes and planning. The Gender Coordinator will track and guide gender research budgeting and implementation, including the development of more precise gender guidelines. Further, the Gender Coordinator will review research proposals and outputs for science quality in relation to gender dimensions. The Gender Coordinator will also provide quality control in terms of reviewing the programs results-based management systems to ensure relevant gender indicators are in place.

Capacity development of non-gender scientists. Livestock and Fish CRP investment in building the capacity of non-gender scientists to integrate gender into technical, systems and value chain research included gender coaching for scientists working on gender-integrated [technical research projects](#). These initiatives demonstrate both the commitment of CRP management to invest in gender integration and the growing interest of researchers to undertake gender-informed research. As a result, a cadre of gender-sensitive technical researchers are available to the proposed program. Building on this 'proof of concept', gender integration coaching will be adopted by the new livestock CRP, possibly with a joint gender/capacity development staff member leading the initiative. In addition, a seminar series on gender research for both gender and technical scientists will continue in the proposed program as a resource for all undertaking gender research.

Incentives for interdisciplinarity. Interdisciplinary research teams are a key mechanism to embed gender analysis throughout the research for development cycle. The commitment from program management and flagship leadership to promote teams that include both social and technical scientists will be operationalized through investments in capacity development of non-gender scientists (see above) and in the increased gender expertise available (see below). Small grants will be incentives for interdisciplinary collaboration, again building on the 'proof of concept' in the

Livestock and Fish CRP where scientists receiving grants also benefitted from 'gender coaching' and were referred to as 'Gender Fellows'. As their capacity to integrate gender is built up, the Gender Fellows are becoming recognized as resource people on gender integration within their flagships and value chains. Annual events such as the April 2016 gender integration writeshop will be used to reinforce interdisciplinary collaboration and capacity development.

Human resources and staff

One lesson learned from Livestock and Fish CRP's experiences is that more gender-integrated research means more input from gender scientists. This translates into the need for additional gender staff to meet the growing demand. The proposed Program will appoint:

- **Gender coordinator.** This person will participate in overall CRP management (see above). Second, (s)he will oversee the overall strategic and integrated gender research agenda. Third, (s)he will coordinate capacity development on gender and team building activities for the Gender Initiative and Gender Fellows' community of practice.
- **Two gender scientists to lead the strategic and integrated gender research.** Livestock and Fish CRP experiences demonstrated that to fully explore gender integration requires additional senior scientist input, alongside the strategic gender research focus. The integration agenda will not only cover gender integration in technical, systems and value chain research, but will also develop emerging ideas as to the institutional aspects of mainstreaming gender in livestock research institutes and programs. Collaboration with the Royal Tropical Institute (KIT) will continue to help address the evolving needs of the program and in joint proposal development and research.
- **Gender focal points.** Each CGIAR centre partner in the program will have a gender focal point to ensure that relevant gender research across the centre is aligned with the program's overall gender agenda and that sufficient staff, budget and other resource allocations are in place.
- **Post-doctoral fellows.** Ideally each flagship would have one gender-related post-doctoral fellow. Several are already in place for the proposed program.
- **Gender experts at each country site.** Over the first two years of the CRP's implementation, a gender expert will be physically located at each of the country sites. This could be a research assistant or technician to support field work and implementation.
- **Gender fellows.** These are non-gender scientists leading gender-integrated research in the research program. See 'incentives for interdisciplinarity' above.

Gender budgeting

The Consortium Office guidelines (June 2015) are the basis for accounting for gender research allocations. These will be updated and better tailored to the proposed program as part of updating the gender strategy. Each flagship has a gender budget allocation: 5% for technical flagships; 10% for environment; and 15% for livelihoods. This can be met through either bilateral or W1/2 allocations. Each flagship handles the gender allocation differently. Some pay for gender expertise in a value chain, others reserve funds for strategic investment. The livelihoods flagship will use W1/2 funding to support research coordination and synthesis as well as strategic gender and integrated research in the value chains. Twenty per cent of the Gender Coordinator costs will come from the management budget. Both technical and gender scientists will seek out further bilateral funding.

To meet demand from scientists for support for gender integration, part of the capacity development budget will be allocated to gender-related activities, including: a joint gender/capacity development staff member to support coaching, the seminar series, and work with partners to build gender capacity. For contributions to review proposals or papers, where a gender scientist is providing a service to the other flagships without full participation in a project or co-authorship, a recharge mechanism will be explored in the new CRP. This may be organized through an annual fee

or through a 'research support' budget line. The intent of this recharge mechanism is to provide added incentives for good interdisciplinary collaboration and co-authorship of outputs; and a fee for services where this does not happen.

Monitoring and evaluating gender progress

Assessing progress in embracing gender-responsive approaches in the program means looking at the process and the results. In addition to monitoring progress on the three gender-related sub-IDs, (see section 1.0.4), results we anticipate include: papers co-authored by gender and technical scientists; gender-responsive technologies developed for gender-differentiated users groups; and, gender analysis integrated into all *ex-ante* assessments. Process indicators include: interdisciplinary research teams; gender coordinator participation in management and governance; that the 'who' of livestock keeping will be more explicit across all CRP projects; and assessing the different needs, preferences, roles and relations of men and women will become an integral part of research analysis and interpretation. Progress on the gender strategy will be assessed by integrating gendered indicators into monitoring and evaluation frameworks, and by developing specific tools (e.g. to measure changes in empowerment). Monitoring and evaluation of gender progress should yield learning to improve practice, as well as demonstrating accountability.

Figure 3.3a Budget estimates for Gender in the Livestock CRP (Cross-cutting & contributions of budgets to sub-IDO)
(For 2017-2022, it assumes 5% growth held constant at CRP and across all FPs and sources of funding)

Year 1 - 2017	Total CRP/Flagship	of which...	Gender W1/2	Gender Bilateral	Gender W3	Total Gender	Gender as % of total
Livestock Genetics flagship	\$ 10,549,446		\$ 681,851	\$ 742,428	\$ 587,362	\$ 2,011,642	19.1%
Livestock Health flagship	\$ 7,970,185		\$ 667,790	\$ 392,774	\$ 242,478	\$ 1,303,041	16.3%
Livestock Feeds and Forages flagship	\$ 6,598,000		\$ 233,320	\$ 68,886	\$ 333,853	\$ 636,058	9.6%
Livestock and the Environment flagship	\$ 5,305,958		\$ 655,433	\$ 164,440	\$ 679,438	\$ 1,499,310	28.3%
Livestock Livelihoods and Agri-food Systems flagship	\$ 8,134,718		\$ 545,927	\$ 54,160	\$ -	\$ 600,087	7.4%
Sub-total Flagships	\$ 38,558,307		\$ 2,784,321	\$ 1,422,688	\$ 1,843,131	\$ 6,050,140	15.7%
Management & cross-cutting budget	\$ 2,408,620		\$ 50,000	\$ -	\$ -	\$ 50,000	2.1%
Strategic Investment Fund	\$ 2,533,074		\$ 379,961	\$ -	\$ -	\$ 379,961	15.0%
Total	\$ 43,500,001		\$ 3,214,282	\$ 1,422,688	\$ 1,843,131	\$ 6,480,101	14.9%
Entire Program - 2017 - 2022	Total CRP/Flagship	of which...	Gender W1/2	Gender Bilateral	Gender W3	Total Gender	Gender as % of total
Animal Genetics flagship	\$ 71,756,412		\$ 4,637,893	\$ 5,049,933	\$ 3,995,188	\$ 13,683,015	19.1%
Animal Health flagship	\$ 54,212,502		\$ 4,542,248	\$ 2,671,612	\$ 1,649,313	\$ 8,863,173	16.3%
Animal Feeds and Forages flagship	\$ 44,879,023		\$ 1,587,020	\$ 468,554	\$ 2,270,838	\$ 4,326,412	9.6%
Livestock and the Environment flagship	\$ 36,090,665		\$ 4,458,197	\$ 1,118,507	\$ 4,621,475	\$ 10,198,179	28.3%
Livestock Livelihoods and Agri-food Systems flagship	\$ 55,331,641		\$ 3,713,351	\$ 368,392		\$ 4,081,743	7.4%
Sub-total Flagships	\$ 262,270,243		\$ 18,938,709	\$ 9,676,998	\$ 12,536,814	\$ 41,152,522	15.7%
Management & cross-cutting budget	\$ 16,383,224		\$ 340,096	\$ -	\$ -	\$ 340,096	2.1%
Strategic Investment Fund	\$ 17,229,748		\$ 2,584,462	\$ -	\$ -	\$ 2,584,462	15.0%
Total	\$ 295,883,215		\$ 21,863,267	\$ 9,676,998	\$ 12,536,814	\$ 44,077,079	14.9%

Annex 3.4 Youth strategy

The CRP's youth strategy focuses on the design and subsequent implementation of interventions that will allow young people to build their future in livestock development. At present, in many societies, young people are disadvantaged in terms of control of and access to assets and resources, including livestock, land, finance and business development services. Agriculture, and livestock keeping in particular, is often considered old-fashioned, yet young people often have the necessary education and drive to improve their livelihoods through livestock.

The topic of young people in agriculture has featured more prominently on the international agenda over the past couple of years (FAO, 2014). In Africa many examples are stressing the importance of building opportunities for young people: At the Africa Agribusiness Incubator Network (AAIN) Conference and Expo held in September 2015 in Nairobi, Kenya, the participants declared their conviction that expanding opportunities and unlocking potentials in the sector requires the participation of young people, who must be excited by agriculture and see it as a viable business. It was noted that young people account for 60% of the unemployed in Africa, that 10 to 12 million young people enter the job market every year, that the rural young working in agriculture are the poorest group among working young people. The Centre for Coordination of Agricultural Research and Development for Southern Africa (CCARDESA) [Youth Declaration](#), made in August 2015 in Durban, South Africa, echoed these sentiments.

Since research on young people was not included in the previous Livestock and Fish CRP, the Livestock CRP fully recognizes the need to integrate opportunities for the young into its research agenda, not least because the rapid transition of the sector will provide exciting new business opportunities with good potential for young people in the context of the rapid growth trajectory. A very different set of challenges will face youngsters in the fragile growth trajectory and will require innovative approaches, beginning with a comprehensive assessment.

The CRP will embark on this new area by assessing and modifying existing tools to systematically scope the opportunities and challenges facing young people in the CRP's focus systems and value chains in priority countries (in the first instance). An important aspect early in the program will be to engage with key partners with whom these approaches will be co-created. This will include exploration through the CRP's partnership with KIT, and its interaction with others, such as the Institute of Development Studies, which have recently assessed issues around youth and agriculture (see for example: [youth employment and imagined futures in rural Africa](#)).

For the systematic assessment, the CRP will build on the six key areas identified by the joint FAO, CTA, IFAD review of youth in agriculture (FAO, 2014c), which cover:

- access to knowledge, information and education;
- access to land;
- access to financial services;
- access to green jobs;
- access to markets; and
- engagement in policy dialogue.

These will be strengthened with key issues related to the livestock sector in particular such as: What drives young people into and out of livestock activities? What are young people's aspirations in the livestock sector? And what is the reality? Under what circumstances would young people benefit from increased participation in livestock value chains and production systems? What interventions would enhance the benefits that young people derive from livestock? What opportunities are there

for young people to bring their skills (for example in ICT) to bear on the livestock sector, enhancing communication and service delivery?

These assessments will form the basis for the CRP to identify, for each flagship and in the priority countries (in the first instance) the entry points, investment requirements and capacity development opportunities that will drive the materialization of the, so-far, underexploited opportunities for youth in the livestock sector.

Experiences of engaging young people in animal agriculture, pursued in developed countries and exemplified by [elements of 4-H](#) and [Future Farmers of America](#) initiatives in the USA also provide learning opportunities that may be adapted and translated to the context of the Livestock CRP, as well as those of other CGIAR centres such as IITA's [Youth Agripreneurs](#).

Links to other activities

Within the CRP, our activities on youth will be strongly linked with activities under the other cross-cutting issues of gender and capacity development.

The CRP will also learn from the experiences of other CRPs in enhancing the quality of research and other activities oriented towards young people. For example, the youth strategies proposed by IM and Drylands CRPs already inform these activities. One of the CRP scientists in the Livestock Livelihoods and Agri-Food Systems flagship will initially play the role of a focal point and coordinator of activities in this area. A summary of opportunities for young people initially identified in each of the flagships is presented below.

Livestock Genetics

This flagship explicitly considers how interventions in the field of livestock genetics can result in opportunities for entrepreneurship and employment for young people, particularly in rural areas, and will promote these opportunities. Areas for possible engagement include keeping genetically superior livestock, participating in livestock genetic improvement programs, facilitating performance recording of animals and acting as feedback agents, or as a service provider.

Livestock Health

This flagship provides opportunities for young people in the provision of services. These include training young people to provide diagnostics and treatment for common diseases through the use of mobile technologies. The transportation of drugs and medicines is a logistical challenge that could be a lucrative business for young people.

Animal health, like human health, is for obvious safety reasons a heavily legislated and regulated sector. Understanding and unlocking the legislative and policy bottlenecks that may hamper the involvement of young people will be important. It may be necessary to concentrate on those services that do not require heavy investment.

Livestock Feeds and Forages

In this flagship, there are promising opportunities for engaging young people in the development of new small-scale businesses. Possibilities include new technologies for connecting farmers with feed and forage suppliers; the production of feeds and forages, for example in irrigation schemes; and the formulation of feeds. Young people can also be supported in the production and marketing of quality forage seeds, the availability of which is a major constraint to the adoption of tropical forages and rangeland species at present.

Livestock and the Environment

The flagship aims to increase the role of young people in environmental management. The focus will be on technologies that reduce the environmental footprint of livestock production and enhance critical ecosystem services; pertinent questions at the outset are what opportunities are or could there be there for this? How can the CRP actively work to create and exploit such opportunities? And how can young people become active agents of change in this field?

Work will be undertaken to understand how livestock production strategies could be adapted to offer opportunities for young people. This is not an area that has been specifically investigated before, but we do know that livestock present new and exciting opportunities for young people to be part of a vibrant transformation of a sector that produces animal-source foods with a reduced environmental footprint, while generating new business opportunities at the same time.

Livestock Livelihoods and Agri-Food Systems

The livestock sector could provide important employment opportunities for young people, not only in production but also at other points along the value chain. While opportunities related to feed activities (e.g. fodder cultivation and trading), animal health and genetics (e.g. service provision) are explored by the technology flagships, and work in this Flagship will coordinate research on the inclusion of young people in relevant institutional arrangements, such as new business models. While there may be considerable opportunities for employment in agriculture and livestock, it may be that these sectors are not very attractive to young people at present. Livestock are perceived (and in some cases, are) labour intensive, require high start-up costs and are, in the case of large animals, only profitable in the medium- to long-term. Young people also face specific constraints in terms of access to the land, capital and knowledge needed to start a new business. On the other hand, they may act as agents of change, given their ability to innovate and use new tools such as mobile technologies. They are often eager to improve their livelihoods.

This Flagship will support the inclusion of young people in livestock value chains by identifying, testing and evaluating specific interventions. These will include: 1) Changing mind-sets with respect to livestock production, for example through school outreach programs; 2) Supporting young individuals and groups in setting up agri-business enterprises, through capacity building and links to other value chain actors (e.g. input suppliers, output markets, and capacity building organizations). The work will be coordinated in Cluster 2, under gender and social equity, as well as Cluster 5, under policy, institutions and markets.

Partnerships

The CRP will depend heavily on partnership to develop and undertake the youth strategy. Both from the perspective of research and assessment, as described above, as well as for scaling up and out the solutions at flagship level and program-wide. For the latter, regional agriculture initiatives will be key and in sites where there are youth organizations that support agriculture, we will take advantage of these to tap additional resources and align our work with national and regional priorities. The inclusive agribusiness initiatives of NEPAD, for example, will provide the evidence needed to elicit support for involving young people in agricultural value chains. Taking results to scale, and ensuring that there is good alignment with the wider development context will mean that the CRP will engage with partners, such as FAO and IFAD, to bring these new dimensions of livestock and youth to the fore.

Budget

Resources for this work will be drawn from the CRP's special initiatives budget and from the portions of funds in each flagship.

Annex 3.5 Results-Based Management and Monitoring, Evaluation, Learning and Impact Assessment

The Livestock's approach to results-based management (RBM) provides the management strategy for focusing on performance and the achievement of outputs, outcomes and impact. The SRF describes an RBM approach as:

Defining development outcomes in addition to understanding, and setting out on, paths to reach those outcomes – while all the time maintaining excellence in science. It also means monitoring experiences and learning from them, to improve performance over time.

The integrated RBM framework in this Annex describes the Livestock CRP's approach to RBM and how this will, in the way it is implemented, demonstrate its commitment to accountability and adaptive management. This annex also describes how its monitoring, evaluation, learning and impact assessment (MELIA) strategy contributes to effective implementation of the RBM framework. Both strategies build on the progress made under the Livestock and Fish CRP, which developed a MEL framework and piloted components of an integrated RBM system.

Results-based management framework

Purpose

The Livestock CRP's RBM framework will act as a comprehensive management system that integrates strategy, results, people, resources, processes and measurements (Treasury Board of Canada). It consists of a set of tools for strategic planning, monitoring and evaluating performance, reporting results, learning from experience, and improving what an institution does (ADB 2006). RBM seeks to support greater accountability, transparency, informed decision making, swift corrective action, and better management of risks and opportunities.

Figure 3.5a presents an overview of the framework. Although fully integrated, a subtle distinction is made between MELIA for evaluating implementation using the Performance Indicator Matrix¹ (Program MELIA), which focuses on accountability for inputs, outputs and associated budgets, and MELIA for evaluating the research approach and its outcome-focused results, to feed back into better articulated theories of change (Research MELIA).

Research MELIA emphasizes the role of the CRP in scientific enquiry: The CRP proposes research in the form of a working hypothesis as to what will yield the desired result and, as it conducts the research, it reviews the evidence as to whether hypotheses are supported or need to be adjusted. The tool recognizes that this constant review of the evidence requires an explicit process of monitoring, evaluation and learning.

Program MELIA emphasizes managing the research program to ensure scarce resources are used optimally. This also requires generating and reviewing evidence to monitor whether the program is performing as expected, with results informing program management. Research and program MELIA are certainly not independent and there are many overlaps and interactions with certain types of information generated by one component used as an input for other components. For this reason, the RBM framework is treated as a single integrated system, highlighting and capitalizing on the CRP's mission as a research program to ensure accountability and to support adaptive management.

¹ Described as the "core of the RBM framework" in full proposal guidance.

Principles

This framework will be implemented based on a set of globally recognized RBM principles: A culture focused on outcomes; Strong leadership in RBM, to model the program's orientation towards results; Participatory approaches at all levels, including partners and stakeholders; Learning and adaptation through the use of performance information; Accountability and transparency, where program staff are held accountable for appropriate levels of results that are achieved and reported in a transparent manner; and User-focused, flexible operational system where RBM tools, procedures and practices can be adapted based on context and needs.

Steps in managing for results

The integrated RBM framework will be part of the overall cycle of planning, budget allocation, risk management, and performance reporting and evaluation, including value for money. Key steps to be used in this cycle include: (i) defining and revising plans based on lessons from the impact pathways and ToC at CRP and flagship levels; (ii) budget allocations based on performance; (iii) planning for monitoring, evaluation, learning and impact assessment, including initial definition of indicators; (iv) establishing responsibilities and accountabilities; (v) monitoring and analysing performance and risks; (vi) reflecting performance and risks information in decision-making; (vii) reporting performance results; and (viii) implementation of necessary changes within the CRP.

CRP and flagship impact pathways and theories of change

The CRP and flagship level impact pathways and ToC were developed with the flagship teams. These serve as the CRP's hypotheses on the ways change is expected to occur, from output to outcome and impact. They are meant to be dynamic and will be adapted as evidence is collected. Assumptions explaining the causality underlying the relationships between the outputs, outcomes and impacts were also identified. These will be tested to validate the theories of change. Furthermore, critical risks were included and will be monitored to support effective management of the CRP.

Tools to support RBM implementation

RBM implementation utilizes an online platform, to integrate the components identified in Figure 3.5a and to support the program's planning, reporting, adaptive management and learning. A key component of this platform is the Strategy and Implementation Plan (SIP) described under the MELIA strategy. The need for such an online system was highlighted in the recent independent external evaluation of the Livestock and Fish CRP; to respond to this recommendation, existing CRP management software is being reviewed to identify which could be adapted to the system design required. The online system is expected to be in place by the start of the Livestock CRP.

Monitoring, Evaluation, Learning and Impact Assessment (MELIA) strategy

To implement the RBM framework, effective MELIA is necessary at project and program levels. A robust and strategic plan is proposed that supports the CRP cycle of planning, budget allocation and reporting. The plan comes into force following submission of the proposal under the guidance of the CGIAR MEL Community of Practice. The community strives to establish some standardization and consistency across the CRPs, contributing to coherent reporting at the portfolio level.

In addition to the above RBM principles, the MELIA strategy focuses on adding value and creating opportunities for adaptive management and learning. The CRP uses a modular approach for implementation of the strategy. This includes a suite of tools, guidelines and best practices. This strategy will be regularly reviewed and necessary adjustments made, to better support staff and management in delivering and improving the performance of the CRP.

MELIA strategy modules

Targeting, Foresight and Prioritization (Research MELIA)

A core component of the CRP science agenda is strategic research on targeting and foresight in the livelihoods flagship. This informs the ToC and guides certain aspects of the CRP research strategy, as well as producing important scientific outputs. Foresight research provides context to evaluate the relevance of current and planned research in relation to future challenges. Targeting research improves the CRP's ability to focus research activities where they are most relevant. Periodic *ex-ante* prioritization exercises draw from the results of foresight and targeting research to assess the probable impact of investments across different lines of research. Such an exercise was conducted during the final stages of preparation of the Livestock CRP, using a multi-criteria prioritization model (see Annex 3.10.2). The results serve as one input into decisions on resource allocation.

Monitoring—Impact Pathway and Theories of Change Evidence Base (Research MELIA)

A core value of research enquiry is the role of evidence and the importance of generating quality evidence and interrogating it appropriately. The ToC Evidence Base (Figure 3.5a) instils this principle in the CRP research planning process to capitalize on, and reinforce, CGIAR's scientific culture. The structure for the base incorporates: what works or not, for whom, why, and under what conditions.

To establish the base, each flagship cluster of activity team has described the essential components of the ToC for its research outputs and outcomes, including the causal sequential logic of why producing output A will lead to outcome B and the most critical assumptions underlying that logic. For each link in the chain and for each assumption, the team identifies the existing evidence or the evidence to be generated and the knowledge gaps that need to be filled. Types of evidence include literature reviews, reviews of past successes and failures, CRP-generated research results, and *ex-ante* and *ex-post* impact assessments. In the Livestock and Fish CRP, such an instrument has been piloted specifically for the selection and continued review of candidate [best-bet interventions](#) for priority testing and, eventually, taking to scale. Specific attention is given to identifying key assumptions regarding unintended consequences and the associated risk mitigation strategy.

Change Pathway Monitoring

This instrument will address a perennial weakness of CGIAR research plans – to explicitly describe the 'messy' middle of the ToC, where researchers seek to effect change beyond their sphere of control. Country-specific change pathway plans are being piloted in the Livestock and Fish CRP² and will form part of the proposed CRP, using these existing tools. Changes (both short- and medium-term) for selected priority countries and flagships, as described in flagship theories of change, will be identified at 'start points' along with assessments of potential barriers, facilitating factors and assumptions underlying the changes. Annual reflection exercises will provide the basis to assess changes in context, the CRP progress since the 'start point', and how barriers or facilitating factors have contributed to observed changes. These reflections will also provide mechanisms to test assumptions and whether they continue to play a significant role in the Program's ToC.

Strategy and Implementation Plan (SIP)

Each flagship will develop and maintain a SIP that describes its ToC, evidence base, priority research outputs and outcomes, approach, activities, and implementation plan in terms of research capacity, partnerships and resource mobilization. The SIP is executed as the Plan of Work and Budget (POWB), and reviewed and amended annually to reflect new learning and understanding that may challenge the validity of the Program's ToC. The spirit of this process is to facilitate regular and critical reviews of the CRP's research strategy as a scientific rather than bureaucratic exercise.

² See <https://cgspace.cgiar.org/handle/10568/72685>

Performance Indicator Matrix and Targets (Program MELIA)

The core instrument to monitor program performance is the Performance Indicator Matrix (PIM). The PIM provides two levels of monitoring. The first is the annual planning and implementation program cycle. This sets a plan and targets for the year, which are monitored to inform management as to whether the research teams are implementing the planned activities and delivering their outputs on time and to specification. The annual plan is defined by the POWB and progress reported at mid-year and year-end, including evidence of the completed deliverables. A specific subset of these deliverables is expected to relate to the actions planned in the Change Pathway Monitoring module and to contribute evidence of progress towards sub-IDOs, as submitted under PIM Table D, for which annual reports are also generated. The second level of monitoring is longer term, and relates to evidence that the Program is contributing successfully to objectives embodied in the IDOs and SLOs (PIM Table A). Changes to be monitored typically fall outside the CRP's sphere of control or even influence and so will rely primarily on regularly compiling appropriate secondary data. Critical to this process is the choice of relevant indicators to monitor for analytical studies (e.g. analysis of value for money).

The CRP is making every effort to build on the work done under the Livestock and Fish CRP to define a minimum set of key indicators and to contribute to the MEL CoP and a common set of indicators for the IDOs (see table 3.5a).

A two-pronged approach will be used to define indicators to assess if the Program has hit them. First, the CRP will seek indicators already in existence that are credible, well recognized, accessible, and are being monitored by other better-positioned organizations (e.g. FAO, World Bank, etc.). Second, where suitable indicators are lacking, the CRP will develop new ones, together with an efficient monitoring system. Furthermore, the CRP supports and seeks to use, where possible, standardized indicators established by the MEL community of practice.

Annex 3.10.3 presents the methodology used to derive targets the CRP aims to achieve for selected indicators.

To complete the monitoring plan, data collection sources and methodologies, responsibilities and timelines are being identified for each of the indicators. A variety of methodologies may be applied depending on the indicator, including document reviews, surveys, case studies, meta-analyses, meta-syntheses, impact assessments and adoption studies.

Evaluation—Internal Review Processes (Research MELIA)

One role of the CRP's Independent Steering Committee is to provide a continuous independent review of the CRP's science agenda and rationale as presented in the SIP and POWB, and committee members are selected in part to ensure adequate coverage of the principal research areas. A schedule of regular *ex-post* impact assessments will also be maintained to confirm and learn lessons from case studies of selected mature research outputs. The studies generate critical evidence to support or challenge hypotheses that research innovations are indeed relevant and appropriately designed, are being adopted, and are translating into the intended benefits and impact, i.e. whether the Program is making progress in turning its ToC into reality.

Independent external evaluation (Program MELIA)

Under the CGIAR Policy for Independent External Evaluation, several types of evaluations have been identified, including Independent Evaluation Arrangement (IEA)-commissioned external evaluations, CRP-commissioned external evaluations (CCEs), and impact assessments. The IEA conducts a cycle

of independent external evaluations of CRPs to ensure accountability, support to decision-making, and lessons for improving the quality and effectiveness of research.

The CRP will implement a rolling evaluation plan to build credible evidence to support decision-making and lessons for improved and more cost-effective programming. This rolling plan will include CCEEs, impact assessments and other studies identified by CRP management. CCEEs will be spread over the cycle to minimize the burden on management and researchers. Joint CCEEs will be sought to harness the resources of multiple CRPs and to assess performance within a given geography (such as supporting site integration plans) or thematic area (e.g. breeding systems, nutrition, gender, etc.).

They will be conducted in line with CGIAR evaluation standards. These CCEEs will comprise a systematic and objective assessment of the program, based on evaluation criteria related to relevance, efficiency, quality of science, effectiveness, impact, and sustainability. The CRP's proposed rolling plan for CCEEs and reviews is shown in table 3.6b.

Impact Assessment (Research and Program MELIA)

The Livestock CRP's impact assessment strategy details how the program will assess impacts and their scale (adoption, influence, outcomes at sub-IDO level, and longer-term impacts). Impacts may arise from the work that the CRP conducts individually or with others, and from antecedent research directly or indirectly related to the CRP.

Impacts are defined as the positive and negative, primary and secondary long-term effects produced by a development intervention, directly or indirectly, intended or unintended. Within CGIAR, impacts are described as the effects of the CRPs on the state of selected development variables related to the SLOs, which are themselves related to the SDGs. Impact assessments emphasize real changes in the benefits experienced by beneficiaries and focus on accumulating evidence on who benefits, how, why and where. There is increasing recognition that interventions that contribute to complex, indirect causal chains with multiple partnerships but limited potential for hard data require a more diverse range of methods to evaluate effectively, especially at the impact level.

The CRP, therefore, adopts a mixed methods approach to evaluating its performance, including *ex-ante* and *ex-post* impact assessments. Specific needs for the conduct of impact assessments are identified as part of the monitoring plan.

Ex-post impact assessments will be designed to determine whether the program has had the desired effects on individuals and institutions and whether the changes are attributable to the program alone or to the program in conjunction with other factors and partners—the latter being by far the likelier case, except in a very few instances. They will be conducted at multiple levels and with multiple data sources, depending on progress along the CRP impact pathway and the relevant geographical domain and target population. For example, one category of impact assessment will include technology-focused studies designed around the counterfactual logic (e.g. randomized controlled trials) and representing individual components of the program where attribution and causal relationships can be studied effectively. A second category will involve policy-oriented research studies, which will use econometric modelling to evaluate the impact of alternative policy innovations, primarily relying on secondary data sources.

The CRP aims to meet high levels of rigour by working with the ISPC Special Project on Impact Assessment (SPIA) and ensuring that impact assessments are carried out to standards set by CGIAR.

Baselines

Appropriate baseline data and/or counterfactuals where needed will be generated to support *ex-post* impact evaluation. These baselines predominantly consist of primary data collection based on the key variables required and will most commonly be used in the evaluation of specific interventions, technology-focused studies, and other activities with a research component. Together with the *ex-post* impact assessment, these baselines will also be used to attribute observed changes to the program and/or its partners in CRP focus countries and within target populations, and to provide evidence for anticipated impact when taken to scale.

The selection of appropriate tools for primary baseline data collection depend on the key variables to be measured and include individual questionnaires, focus group discussions, key informant interviews and other methods, at the household, community and national level.

Establishing baselines for development outcomes (IDOs and SLOs, further evidence for sub-IDOs) will mostly involve secondary data collection and synthesis (e.g. situational analysis) from sources such as World Bank indicators, country-level Living Standards Measurement Studies (LSMS) and FAOSTAT, among others. Baselines for *ex-post* impact assessment may also contribute data to measuring and attributing changes in development outcomes.

Reporting

The annual reporting process, as presented in the SIP and implemented through the POWB, will be the key method for the CRP to describe its progress and results. Reporting of results will be conducted at the output and outcome levels and, when possible, at the impact level. A review of data collected on indicators for PIM, and assumptions and risks as expressed in the ToC will serve as guides for reporting on results. As part of this process, the CRP will also document any lessons and changes to the program's implementation, including to the theories of change and monitoring plan.

Improvement and learning

In line with RBM principles, the CRP will take a variety of measures to support learning from the information collected through MELIA. The CRP will integrate these measures as part of its planning and reporting cycle with clear roles and responsibilities. The measures include:

- Annually reviewing and revising the theories of change based on evidence collected, and conducting contribution analyses to reflect and strengthen the CRP performance story;
- Annually conducting reflection sessions on performance and risk information collected throughout the year;
- Adjusting and prioritizing the CRP's implementation in line with the evidence collected;
- Implementing and adjusting mitigation measures to manage risks;
- Documenting lessons learned and best practices (e.g. meta-synthesis of lessons from evaluations);
- Conducting evaluation workshops to reflect on and adjust to the evaluation findings and lessons;
- Knowledge management and information sharing; and
- Following up on learning decisions, including actions plans in response to evaluation recommendations.

Budget Allocation to RBM and MELIA

The RBM-MEL system is overseen by a scientist leading the CRP's impact assessment work. The scientist will be an agricultural economist specializing in evaluation and impact assessment methodologies. The CRP Program Support Coordinator, who is an evaluation specialist, and the impact assessment scientist will be supported by two higher level research technicians. The first is a specialist in research design and methods, responsible for coordinating the evidence base associated with the Program's ToC. This specialist will give particular attention to ensuring more rigorous

research design at target sites, so as to allow cross-site learning. The second technician is an M&E specialist, responsible for coordinating the PIM and supporting the monitoring of change pathways.

In addition to the three positions, funds are allocated to (i) at least one CCEE each year (USD 150,000/year funded out of the Program Management Unit budget). As advised, opportunities to tap funding for joint CCEEs with other CRPs will be explored; table 3.5c lists potential candidates; (ii) baseline studies, funded from the Strategic Investment Fund for up to \$300,000 in Years 1, 2 and 4 (anticipating the addition of one or more focus countries; (iii) major impact assessment studies will be funded mainly from the Strategic Investment Fund up to \$400,000 per year and from bilateral funding when possible, and flagships also budget \$50,000 per year for impact assessment; impact assessments are envisaged to range from smaller strategic studies on specific technologies (USD 30,000) to larger RCT-type studies (USD 150,000-400,000); (iv) monitoring and data collection on change pathways at target sites (six sites x USD 10,000/year); (v) consultancies for maintenance and continued development of an online platform (USD 20,000/year). Major costs for other data collection for M&E inputs are expected to be embedded within bilaterally-funded projects.

Table 3.5a Draft indicators for IDOs and proposed monitoring approach

IDOs	Proposed indicators	Proposed monitoring approach
Increased resilience of the poor to climate change and other shocks	Income of small-scale producers against national poverty lines.	Country-level LSMS; WB indicators; Country National Housing Surveys
Enhanced smallholder market access	Level of supportiveness of policy and legislative environment towards the development of small-scale production and marketing systems; Proportion of livestock market sales by smallholders.	Desk review; Knowledge Attitude and Practice surveys
Increased incomes and employment	Income of small-scale producers against national poverty lines; Number of people working in small- to medium-scale livestock production (disaggregated by gender and age).	Country-level LSMS; WB indicators; Country National Housing Surveys
Increased productivity	Livestock yield gap changes (actual yield as a percentage of attainable yield); Increase in diversity of genetic resources and their use (along with productivity increases due to this); Percentage of women, men, indigenous people and local communities with secure rights to land, property and natural resources, measured by (i) percentage with documented or recognized evidence of tenure, and (ii) percentage who perceive their rights to be recognized and protected.	Desk review; FAO, Program; Farm household surveys
Improved diets for poor and vulnerable people	Percentage of total daily energy intake from protein in adults; Percentage of adults/women (15-49 years) who consume at least 5 out of 10 food groups [increase in dietary diversity] ; Prevalence of stunting and wasting in children < 5 years; Number of people (and % who are female) without deficiencies in essential micronutrients: iron, zinc, iodine, vitamin A, folate and B12.	Country-level LSMS; Country National Housing Surveys
Improved food safety	Reduced incidence of zoonotic diseases in people and animals;	OIE; Zoonotic disease prevalence

	Number of regulations/laws enacted and enforced to maintain and improve the quality and safety of the target commodities.	testing on farm (or near appropriate unit); Community; Community surveys
Improved human and animal health through better agricultural practices	Number of people and % who are female without deficiencies in essential micronutrients: iron, zinc, iodine, vitamin A, folate and B12; Reduced incidence of zoonotic diseases in people and animals.	Country-level LSMS; Country DHS, Community Surveys; Country National Housing Surveys
Natural capital enhanced and protected, especially from climate change	Changes in forest area and land under cultivation (million ha).	Remote sensing; Life Cycle Assessment (LCA), IPCC data
Enhanced benefits from ecosystem goods and services	Land area with increased protection of soils and water (million ha).	Remote sensing; Life Cycle Assessment (LCA) data
More sustainably managed agro-ecosystems	Net GHG emissions in the agriculture, forest and other land use sectors (tCO ₂ e).	Remote sensing; Life Cycle Assessment (LCA) data
Mitigation and adaptation achieved	Reduction in number of ruminant livestock kept by small-scale producers; hectares of land brought under environment friendly technologies; or the number of better breeds owned by final beneficiaries.	Country livestock censuses, Community surveys
Equity and inclusion achieved	Increased proportion of assets and resources owned and controlled by women; equity in level of labour and energy expenditure for women and men in livestock production; Percentage of women, men, indigenous people and local communities with secure rights to land, property and natural resources, measured by (i) percentage with documented or recognized evidence of tenure, and (ii) percentage who perceive their rights to be recognized and protected.	Country-Level LSMS; Country National Housing Surveys
Enabling environment improved	Level of supportiveness of policy and legislative environment to the development of small-scale (livestock) production and marketing systems.	Country-Level LSMS; Country-National Housing Surveys; Knowledge Attitude and Practice Surveys
National partners and beneficiaries enabled	Level of supportiveness of policy and legislative environment towards the development of small-scale production and marketing systems.	Country-National Housing Surveys, Country-Level LSMS
Increased resilience of the poor to climate change and other shocks	Income of small-scale producers against national poverty lines.	Country-level LSMS; WB indicators; Country National Housing Surveys

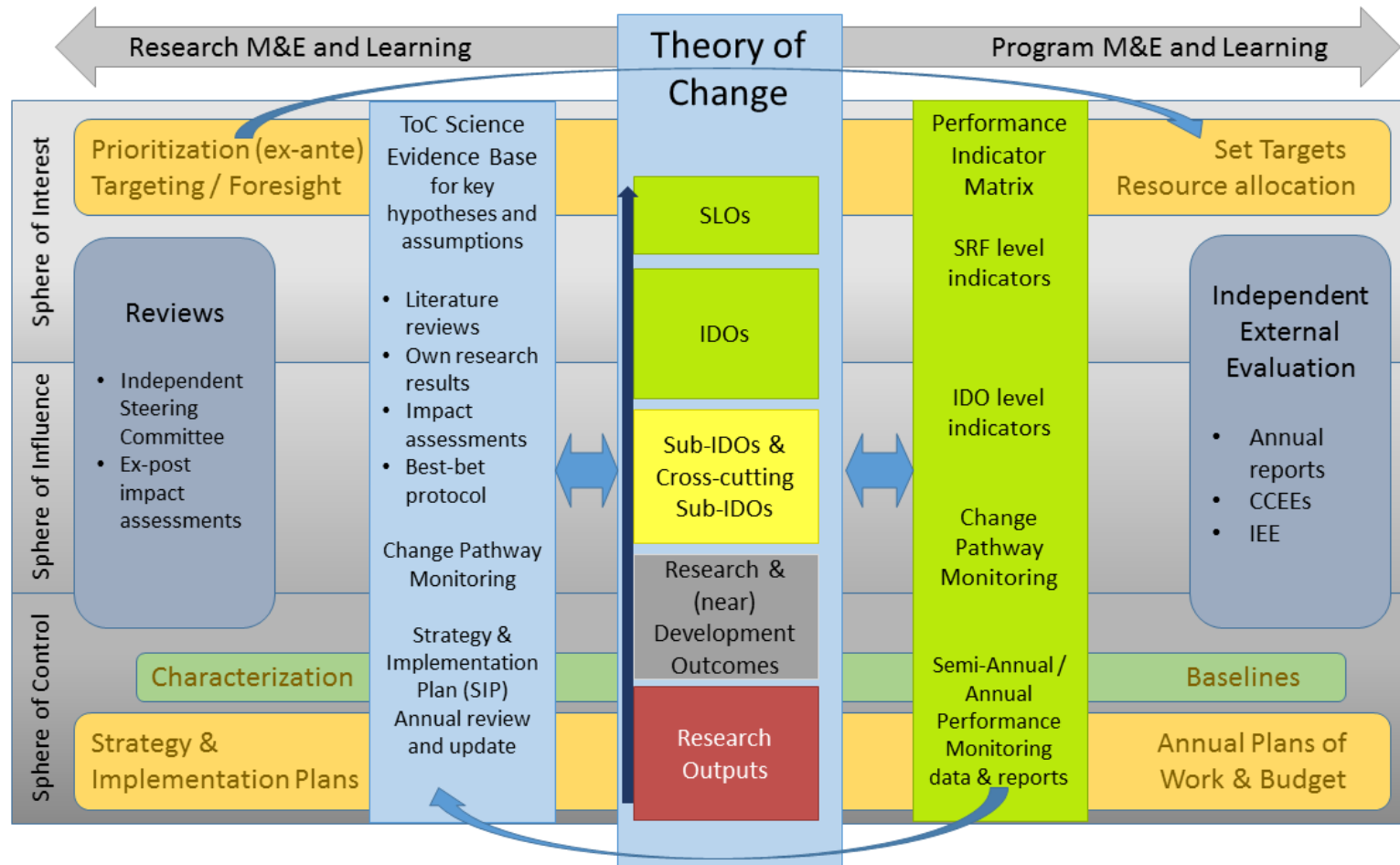
Table 3.5b Proposed CCEEs and reviews for the Livestock CRP

Review or evaluation	Dates	Evaluation focus	Geographic focus	Budget	Participating centres
Capacity development	2017	Cohesion with FP agenda and ToC	Global	USD 150K	ILRI, KIT, GIZ, CIAT, ICRAF, ICARDA, SLU, WUR, IWMI
Gender and youth agendas	2018	Cohesion with FP strategies and ToC	Global	USD 150K	KIT, GIZ, CIAT, ICRAF, ILRI, ICARDA, SLU, WUR, IWMI
Forage breeding efforts	2019	Impacts and way forward	Latin America and Sub-Saharan Africa	USD 150K	CIAT, ILRI
Research and partnership to support scaling	2020	Cohesion with FP agenda	Global	USD 150K	GIZ, CIAT, ICRAF, ILRI, ICARDA, SLU, WUR, IWMI, KIT
Cross-CRP: CGIAR Site Integration in Ethiopia	2021	Achievements and Synergies across CRPs	Ethiopia	USD 20K	ILRI, ICARDA Crop Centres: ICRISAT, CIMMYT
Cross-CRP: Full purpose Platform	2021	Achievements and Synergies across CRPs	Global	USD 20K	ILRI, ICARDA Crop Centres: ICRISAT, CIMMYT
Vaccine development	2022	Achievements and priorities	Global	USD 150K	ILRI

Table 3.5c Candidate cross-CRP CEEEs

Evaluation topic	Partner CRPs
The role of livestock in climate change in East Africa	CCAFS and LDC
Full-purpose crop breeding	All other AFS CRPs
Systems-based research to enhance the productivity and sustainability of crop–livestock systems in drier areas	LDC
Enhancing the role of livestock in mitigating soil degradation	WLE

Figure 3.5a Integrated monitoring, evaluation, learning and impact assessment framework



Annex 3.6 Linkages with other CRPs and site integration

The development of a new portfolio of CRPs is a great opportunity to create synergies and add value through collaboration. A key lesson from the Livestock and Fish CRP was that opportunities for this were lost because the CRPs had been planned and developed as individual programs, with insufficient attention being devoted to cross-CRP links. In reality, some of these links were in place through the involvement of Centres and indeed the same staff were often working in different CRPs creating de facto CRP-to-CRP links. But these were neither very visible nor were they captured well in the reporting and M&E frameworks used for the Livestock and Fish CRP.

The Program's strategy for cross-CRP collaboration is to define the key areas for collaboration in relation to the ToC, the comparative advantage of each CRP, the potential added value from collaboration and the identification of common objectives. For example, in relation to the impact pathway towards influencing policy, it makes sense to collaborate with the global integrative CRPs, which are well placed to be at the 'top table' in global, regional and, at times, national fora.

Strategic collaborative relationships with other CRPs include:

A4NH

The main focus of collaboration with A4NH will be on issues of food safety, antimicrobial resistance, zoonoses, emerging infectious diseases, diseases in landscapes, and human nutrition. Collaboration will be largely through the Livestock Livelihoods and Agri-Food Systems Flagship and to a lesser extent with the Livestock Health Flagship. A4NH will provide methods and tools for the study of the contribution of animal-source foods to nutrition, integrated food safety methodologies, and tools and behavioural change approaches to nutrition and food safety, including gender dimensions in target value chains, and access to global fora. Much of the research will be operationalised through using shared research sites and value chains. The collaboration will also be facilitated by ILRI leading the A4NH Flagship on Food Safety and Zoonoses and co-leading the Improving Human Health Flagship.

PIM

There are three main areas of collaboration with PIM: work on building livestock into IMPACT modelling for foresight and *ex-ante* impact studies, on value chain methodology development, and on land tenure/property rights issues (all with the livelihoods Flagship). The first two of these areas will benefit from ILRI's involvement in the first phase of PIM (ILRI is a Tier 2 partner in PIM), while the third area has been identified as a new area of shared interest.

CCAFS

Collaboration with CCAFS will focus on mitigating emissions from livestock systems, adaptation options for livestock and mixed crop–livestock systems and engaging in global policy discussions (with the Livestock and the Environment Flagship). A critical role for CCAFS is to provide information on future climate change scenarios to help guide and target research in the livestock CRP flagships. This collaboration will continue much of the work started under the Livestock and Fish CRP. The hosting of the CCAFS Flagship Priorities and Policies for CSA and the East Africa Regional Program Leader at ILRI and the CCAFS Flagship Climate-Smart Technologies and Practices at CIAT is an important structural mechanism for assisting this collaboration.

WLE

Three topics of mutual interest have been identified: development of strategies, tools, models and indicators to support sustainable intensification with WLE Flagship on Enhancing Sustainability

Across Agricultural Systems; restoration of degraded land with WLE Flagship on Restoring Degraded Landscapes; and increasing land and water productivity in livestock systems with WLE Flagship on Land and Water Solutions for Sustainable Intensification. Both Livestock and the Environment and Livestock Feeds and Forages flagships will contribute to research under the three WLE flagships identified for collaboration. While much of the focus of the systems research in the livestock CRP is at the farm level, collaboration with WLE provides the opportunity to work at multiple scales and offers entry points to global fora.

FISH

Cross CRP-collaboration will be achieved by strengthening the already established research partnerships between in the Livestock and Fish CRP around animal health, genetics and feeds. Tilapia disease has been identified as a topic of mutual interest for joint research in Egypt under the Livestock Health Flagship of the Livestock CRP.

LDC

LDC provides the opportunity to collaborate on systems and productivity in the drylands (with the livelihoods Flagship), especially at some of the existing Drylands CRP sites.

Multi-CRP Platform on full-purpose Crops (with Maize, Wheat, Rice, RTB and LDC)

A novel aspect of cross-CRP collaboration is the creation of a platform for the development of full-purpose crops involving the Livestock, Maize, Wheat, Rice, RTB and LDC CRPs, for joint R4D for value addition and improved livelihoods. Anchored in the Livestock Feeds and Forages Flagship, the platform will comprise a network of CGIAR and non-CGIAR labs equipped with rapid phenotyping facilities, based on near-infrared spectroscopy technology. The main task is to assess the nutritive value of crop residues (straws, stovers, vines, etc) and the work will be supported by animal nutrition labs in India, Ethiopia and Nigeria. While this Livestock CRP will provide the required information on nutritive value for livestock, the other CRPs will embed genomic work in their trait discovery flagships and breeding in their crop breeding flagships. The outputs will be a wealth of new crop varieties that can bring about transformative change in livestock feeding in many systems. The collaboration builds on a highly successful proof of concept with several crops but extends this to a broader range of CGIAR mandate crops.

Multi CRP Consortium on BNI with Wheat, Maize, Rice, LDC and CCAFS

This consortium is led by JIRCAS and aiming at capitalizing the benefits of BNI in multiple crops, as new sources of nitrogen-use efficiency and to reduce N₂O in many farming systems, across crops / rotations. Currently, the BNI work in forages is focused on technology development and housed in the Livestock Feeds and Forages Flagship.

FTA

Collaboration will mainly be on sharing knowledge, tools and methods for systems where trees and livestock interact with a particular focus on West African parklands, Eastern and Southern Africa and seasonally dry Central America.

Genebanks Platform

The main collaboration with the Genebanks Platform will be provision of forage germplasm from the forage genebanks at ILRI, CIAT, ICARDA and ICRAF for forage breeding work and for testing in range of systems. In addition, the crop genebanks will provide germplasm for the full-purpose work described above.

Genetic Gains Platform

The main collaboration with the Genetic Gains Platform will be with the Livestock Feeds and Forages Flagship. The platform will provide tools and services to support full-purpose crop and tropical forage breeding, bioinformatics tools and services, genotyping tools and services, phenotyping tools and services. The Livestock CRP will contribute to a community of practice in plant breeding. The platform will provide access to shared genotyping services and bioinformatics support to the Livestock Genetics Flagship.

Big Data Platform

The platform will provide data management support following, and building on, the work of the CGIAR data management taskforce, communities of practice to share and build off work others are involved in, shared services for analytics and data storage and inspire projects to pilot novel big data approaches. Similarly, the Livestock CRP will contribute to each of these areas and in particular to specific inspire projects that relate to the CRP, such as in genetics and genomics analyses.

Collaboration mode

Given limited W1/2 funding, most cross-CRP collaboration will have to be funded through joint resource mobilization efforts. These will be driven by the identification of common objectives and research agendas, followed by the joint development of proposals for funding. However, some limited W1/2 funding may be needed at the outset, for example strategic analysis and scoping studies.

Template 1: Overview of Inter-CRP Collaboration: Provide and Receive

(Per Flagship on)	Flagship on Livestock Genetics	Flagship on Livestock Health	Flagship on Livestock Feeds and Forages	Flagship on Livestock and the Environment	Flagship on Livestock Livelihoods and Agri-Food Systems
OR (Per Flagship on cluster)					
Maize, Wheat Rice, RTB LDC (Multi CRP Platform on Full Purpose Crops)			<p><i>CRP provides:</i> Information on feed supply and demand scenarios; data on nutritive value of crop residues of different varieties/cultivars and promising feed and fodder value chains</p> <p><i>CRP receives:</i> Cultivars for phenotypic testing. Data on genomics and genetics of traits. Management options and information</p>		
Wheat, LDC, CCAFS BNI consortium to exploit genetic opportunities reduce nitrous oxide emissions and nitrate leaching of forage and food crops working on BNI. With JIRCAS (Japan International Research Center for Agricultural Sciences),			<p><i>CRP provides:</i> Methodologies (bio-assay, molecular) for assessing BNI activity, identification of genes, inclusion in bred grasses</p> <p><i>CRP receives:</i> Advances in methodology tested over diverse crops, measurement of effects on GHG emissions and its use in policy</p>		
AN4H		<i>CRP provides:</i> Models and data on changing disease patterns and threats including zoonotic			<i>CRP provides:</i> Access to research sites in key countries for joint studies on nutrition and animal-

(Per Flagship on)	Flagship on Livestock Genetics	Flagship on Livestock Health	Flagship on Livestock Feeds and Forages	Flagship on Livestock and the Environment	Flagship on Livestock Livelihoods and Agri-Food Systems
		<p>diseases. Models and data related to antimicrobial use and resistance in livestock sector. Disease diagnostic tools and vaccines.</p> <p><i>CRP receives:</i> Access to global platforms on public health.</p>			<p>source foods. Provides methods for analysis of livestock-mediated nutrition outcomes. Supports collaboration with local researchers. Avenue for policy dialogue.</p> <p><i>CRP receives:</i> Methods for the study of the contribution of animal-source foods to nutrition. Integrated food safely methodologies and tools. Behavioural change approaches to nutrition including gender dimensions.</p>
LDC			<p><i>CRP provides:</i> Information on forage and feed varieties suitable for dryland systems and on cropping options beneficial for livestock</p> <p><i>CRP receives:</i> Access to seed distribution systems</p>		<p><i>CRP provides:</i> Livestock options (technologies and institutional arrangements) for livelihood improvement</p> <p><i>CRP receives:</i> Access to research sites in dryland areas to assess integrated approaches to livelihood improvement</p>
PIM	<i>CRP receives:</i> Methods to support work on technology adoption and impact	<i>CRP provides:</i> Opportunities to work jointly on livestock health and management issues	<i>CRP receives:</i> Analysis on science policies to advance vaccines, improved fodder, and other technologies and practices	<i>CRP provides:</i> Facilitation and support to enable access to at least one agreed upon project area to be used as case study	<i>CRP provides:</i> Expert inputs on livestock agri-food systems, including results of research on impacts and technologies

(Per Flagship on)	Flagship on Livestock Genetics	Flagship on Livestock Health	Flagship on Livestock Feeds and Forages	Flagship on Livestock and the Environment	Flagship on Livestock Livelihoods and Agri-Food Systems
		<p><i>CRP receives:</i> Analysis on science policies to advance vaccines, improved fodder, and other technologies and practices</p> <p>Methods to support work on technology adoption and impact</p>	Methods to support work on technology adoption and impact	<p>research site(s) (e.g. in Tanzania and/or Ethiopia).</p> <p>Conceptual/intellectual and methodological advice including inclusion of pastoral land issues. Access to global networks and platforms to share the CRP's findings.</p> <p>Entry points to engage with government and other stakeholders, and tools, methods, and results of studies, technical advice, lessons related to governance of shared landscapes including rangelands and land-based investments – through Sustainable Rangeland Management Project in Tanzania.</p> <p>Case studies on resilient livelihoods for livestock holders</p> <p><i>CRP receives:</i> Access to different research models of research, concept and intellect informed by experience of other food system CRPs. Joint analysis and learning. Evidence from other case studies that can strengthen evidence base in the two clusters - Enhanced tenure security; Managing shared landscapes.</p>	<p>related to animal productivity, livestock value chains, and climate change, as well as selected regional analyses in Africa, Asia and Central America, to support continued improvement of foresight modeling tools and global analyses</p> <p>Shared empirical results, shared effort to develop tools on gender</p> <p>Shared results from application of value chain tools</p> <p>Opportunities for collaborative testing of scaling tools</p> <p>Joint investment in East Africa value chain hub</p> <p>Suggested topics for political economy analysis</p> <p><i>CRP receives:</i> Country-level tools and analysis of livestock sector investment and policy impacts on growth, poverty and employment in selected countries</p>

(Per Flagship on)	Flagship on Livestock Genetics	Flagship on Livestock Health	Flagship on Livestock Feeds and Forages	Flagship on Livestock and the Environment	Flagship on Livestock Livelihoods and Agri-Food Systems
				<p>Tools, methods, and studies for land governance projects in Tanzania, Kenya, Ethiopia</p> <p>Input to civil society independent monitoring and dialogue on good governance and inclusive agricultural investment in Tanzania</p> <p>Evidence on impact of social protection on livestock holdings during drought</p>	<p>Inventory and advancement of gender tools and methods, shared learning across CRPs</p> <p>Foresight modeling tools, expertise, and results of global, multi-commodity analyses to support specific analyses of interest to (and led by) Livestock, including research on impacts and technologies related to animal productivity, livestock value chains, and climate change, as well as selected regional analyses in Africa, Asia and Central America</p> <p>Adjusted methodology for measuring postharvest losses suitable for dairy and livestock products</p> <p>Tools and capacity building for prioritization of value chain interventions, and impact assessment of interventions</p>

(Per Flagship on)	Flagship on Livestock Genetics	Flagship on Livestock Health	Flagship on Livestock Feeds and Forages	Flagship on Livestock and the Environment	Flagship on Livestock Livelihoods and Agri-Food Systems
					Tools for informing scaling up of organizational innovations Joint investment in East Africa value chain hub
CCAFS	<p><i>CRP provides:</i> Information on technology (genetics) options to reduce GHG emissions from livestock. Information on adaptation options</p> <p><i>CRP receives:</i> Priority setting for CSA: downscaled climate projections, regional climate outlook, prioritisation frameworks.</p>	<p><i>CRP provides:</i> Information on technology options (animal health) to reduce GHG emissions from livestock. Information on adaptation options</p> <p><i>CRP receives:</i> Priority setting for CSA: downscaled climate projections, regional climate outlook, prioritisation frameworks.</p>	<p><i>CRP provides:</i> Information on technology (feeds and forages) options to reduce GHG emissions from livestock. Information on adaptation options</p> <p><i>CRP receives:</i> Priority setting for CSA: downscaled climate projections, regional climate outlook, prioritisation frameworks. Climate-smart village participatory testing in a broader climate change context (e.g. inclusive of climate information services, local adaptation planning)</p>	<p><i>CRP provides:</i> Options for reducing climate change impact of livestock and mitigation of GHG emissions in agricultural systems. Options for adaptation of livestock systems to climate change.</p> <p><i>CRP receives:</i> Priority setting for CSA: downscaled climate projections, regional climate outlook, prioritisation frameworks. Criteria, standards and methods for estimation of GHG emissions. Analyses and tools to identify priority mitigation options. Identification of economic and policy incentives for adoption. Access to global (e.g. IPCC), regional and national fora on climate change.</p>	<p><i>CRP provides:</i> Integrated farm-level technologies and strategies in relation to climate change (e.g. for testing in climate smart villages).</p> <p><i>CRP receives:</i> Priority setting for CSA: downscaled climate projections, regional climate outlook, prioritisation frameworks. Global analyses of opportunities for climate services and associated safety nets; Insurance Learning Platform.</p>
WLE			<p><i>CRP provides:</i> Forage and rangeland technologies for degraded land improvement. Feeds and forages for improved water use efficiency.</p>	<p><i>CRP provides:</i> Livestock options for sustainable land management. Sustainability indicators related to livestock. Understanding and modelling of livestock production system</p>	

(Per Flagship on)	Flagship on Livestock Genetics	Flagship on Livestock Health	Flagship on Livestock Feeds and Forages	Flagship on Livestock and the Environment	Flagship on Livestock Livelihoods and Agri-Food Systems
			<i>CRP receives:</i> Options to strengthen crop-feed-fodder and forage improvement to scale across landscapes through ALWM solutions	dynamics to address and improve natural resource use. <i>CRP receives:</i> Landscape assessment of land degradation and resource flow management strategies through business models. Input on conceptualizing and developing activities around sustainable natural resource use. Access to policy fora.	
FISH ASF		<i>CRP provides:</i> Expertise in bacterial disease diagnostics, molecular biology, livestock vaccines. <i>CRP receives:</i> Access to sites where on farm performance of improved fish strains will be evaluated, access to disease fish samples, expertise in aquatic epidemiology and aquatic animal diseases	<i>CRP provides:</i> Information on feed quality of aqua feed and feed ingredients. NIRS equations for phenotyping. <i>CRP receives:</i> Aqua feed and feed ingredients		<i>CRP provides:</i> Methods for value chain assessment applicable to perishable products. Methods for assessing contribution of animal-source-foods in human nutrition <i>CRP receives:</i> Access to sites for joint analysis and learning
FTA			<i>CRP provides:</i> Cultivars and management practices relevant to silvopastoral systems. <i>CRP receives:</i> Knowledge, tools and methods for systems where trees and livestock interact with a particular focus on West African Parklands, Eastern		<i>CRP provides:</i> Knowledge, tools, and methods relevant to silvopastoral systems.

(Per Flagship on)	Flagship on Livestock Genetics	Flagship on Livestock Health	Flagship on Livestock Feeds and Forages	Flagship on Livestock and the Environment	Flagship on Livestock Livelihoods and Agri-Food Systems
			and Southern Africa and seasonally dry Central		
Genebanks			<p><i>CRP provides:</i> Information on priority species/cultivars</p> <p><i>CRP receives:</i> Forage species/cultivars adapted to different contexts</p>		<p><i>CRP provides:</i> Impact assessment methods, applicable to Genebank products</p> <p><i>CRP receives:</i> Access to sites for joint analysis and learning</p>
Genetic Gains	<p><i>CRP provides:</i> Data on livestock genotypes.</p> <p><i>CRP receives:</i> Access to shared genotyping platforms</p>		<p><i>CRP provides:</i> Application and testing in forages and feed crops. Contribution to community of practice in plant breeding</p> <p><i>CRP receives:</i> Generic tools and services to support full purpose crop and tropical forage breeding excellence, bioinformatics tools and services, genotyping tools and services, phenotyping tools and services. Trait mobilization tools and services</p>		
Big Data	<p><i>CRP provides:</i> data management support, shared experiences on big data and big data analytics, contribute to shared services and inspire projects.</p> <p><i>CRP receives:</i> data management support, shared experiences on big data and big data analytics, shared services and inspire projects.</p>		<p><i>CRP provides:</i> Access to Forage quality data (e.g. NIRS platform)</p> <p><i>CRP receives:</i> Methodologies and approaches to analyse large data sets</p>		

Template 2a: Partnerships of Livestock CRP with other CRPs, activities, mode, geographies and outcomes sought

Partner CRP	ACTIVITY [COUNTRY(IES) IN WHICH THIS TAKES PLACE]	LIVESTOCK CRP ROLE	COLLABORATING CRP ROLE	COLLABORATION MODE	OUTPUT; ADDED VALUE; TARGET COUNTRIES
Maize, Wheat Rice, RTB LDC (Multi CRP Platform on Full Purpose Crops)	A cross-CRP platform linking the Livestock CRP with several of the other agri-food systems CRPs will be established aimed at improving fodder resources from crop residues. This work will be guided by the Livestock CRP but embedded in the trait discovery and crop breeding flagships of Maize, Wheat Rice, RTB, LDC using the 'full purpose crop' concept that concomitantly, improves food, feed and fodder traits of crops with no additional land and water need.	Evaluation the nutritive value for livestock of crop residues and by products	Incorporation of nutritive value of crop residues and by products into crop breeding programs	Joint research mobilisation.	New full purpose varieties and cultivars that improve livestock feeding and productivity. Target countries: India, Bangladesh , Ethiopia, Tanzania, Uganda, Mali, Niger, Nigeria
New cross-CRP platform to work on Biological Nitrification Inhibition (with JIRCAS)	A cross-CRP platform with Wheat, LDC, CCAFS and expanded with JIRCAS to advance research on BNI	Research on BNI in forages, methods development	Sharing of methodologies and joint work on advancing the state of the art	Joint research mobilisation.	Methods, technological advances, inclusion of BNI in crops and forages Target countries: Global
AN4H	Development and use of common tools for improved quantification of food consumption at intra-household level. A toolkit of new options on nutrition-sensitive and cost-effective technological, institutional, and behavioural interventions that increase availability, affordability and access of animal-source foods to poor consumers. Collaborative research on food safety in informal animal-source food markets.	Access to research sites for joint studies on nutrition and animal-source foods. Supports collaboration with local researchers. Avenue for policy dialogue on mechanisms to increase access of animal-source food to poor consumers. Provide livestock value chain platforms and joint action	Provides methods for the study of the contribution of animal-source foods to nutrition, including integrated food safely methodologies and tools Provides methods for food safety analysis along animal-source-food supply chains.	Much of the collaboration will be through a cross-CRP community of practice facilitated by A4NH. Joint resource mobilisation.	Outputs: Options on nutrition-sensitive institutional and behavioural interventions that increase availability, affordability and access of animal-source food to poor consumers. Target countries: Ethiopia, Uganda Outputs: New risk based approaches to enhancing food safety in livestock value chains

	<p>Collaboration on zoonotic diseases of livestock, mainly through co-location of research sites with a possible focus on cysticercosis in sub-Saharan Africa, brucellosis in India, Japanese encephalitis in Vietnam.</p> <p>Collaboration on antimicrobial resistance</p>	<p>research opportunities on mitigating food safety risks.</p> <p>Livestock disease modelling and prioritization. Provision or research sites in target countries</p> <p>Livestock system analysis and modelling.</p>	<p>A4NH will participate in policy platforms led by CRP. A4NH will contribute through ILRI to discussions with FAO, OIE, Chatham House process etc.</p> <p>Links to public health</p>		<p>Target countries: Ethiopia, Uganda</p> <p>Outputs: Identification of zoonotic disease risks and 'one health' approaches to their control</p> <p>Target countries: Some aspects will be global component but with country focus on Kenya, India, Vietnam.</p> <p>Outputs: Strategies for reduction of use antimicrobials in livestock. Policy support/advice. Target countries: A global component with case studies in Kenya, India, China, Vietnam</p>
LDC	<p>Development of forage seed delivery systems in drier areas.</p> <p>Piloting of crop-livestock related livelihood options in dryland areas</p>	<p>Identification of suitable forage species</p> <p>Identification of suitable technologies and institutional arrangements to improve livelihoods and resilience in dryland areas</p>	<p>Access to existing and improved seed systems</p> <p>Access to sites for joint pilot testing.</p>	<p>Joint research mobilisation</p> <p>Joint resource mobilisation</p>	<p>Outputs: New forage seed delivery mechanisms in dry areas Target countries: Primarily sub-Saharan Africa and South Asia</p> <p>Outputs: A suite of crop-livestock related livelihood options tested and evaluated in dryland areas Target countries: Primarily sub-Saharan Africa and South Asia</p>
PIM	<p>Foresight modelling, especially development of the livestock module of the IMPACT model and its use in foresight/ex-ante impact assessment.</p> <p>Value chain methodology development and the participation in</p>	<p>Information for updating, parameterising and validating of livestock models</p> <p>Methods for value chain assessment and analysis. Methods for impact</p>	<p>Information on future trends and scenarios for the agriculture and livestock sectors.</p> <p>Methods for value chain assessment and analysis.</p>	<p>Joint research mobilisation</p> <p>Joint resource mobilisation</p>	<p>Outputs: Updated scenarios from IMPACT, incorporating livestock related information Target countries; Global</p> <p>Outputs: Joint value chain assessment and analysis toolkit, applicable to perishable products</p>

	<p>the value chain hubs, especially in Addis Ababa.</p> <p>Development and piloting of innovations for improving implementation of land policy and legislation in rangelands.</p>	<p>assessment (joint development with PIM)</p> <p>Case studies of mechanisms to facilitate access to resources in pastoral systems.</p>	<p>Methods for impact assessment.</p> <p>Methods and insights to land tenure issues</p>		<p>Target countries: Global: Ethiopia, Tanzania, Uganda.</p> <p>Outputs: Policy support, advice, briefs on improved land tenure and resource access arrangements in pastoral areas. Target countries: Ethiopia, Kenya, Tanzania.</p>
CCAFS	<p>Incorporation of climate-smart livestock and feeding technologies and practices into climate smart villages in Burkina Faso, Mali, Ethiopia, Kenya, Indonesia and Vietnam</p> <p>Research on feed and forage options, breeding and health interventions to reduce GHG emissions from livestock systems.</p>	<p>Improved management practices, breeds and cultivars. Integrating CSA recommendations in technology guidance for upscaling Contribution to the Rural Household Multiple Indicator Survey.</p> <p>Identification of technology options to reduced GHG emissions from livestock</p>	<p>For all climate related research CCAFS will supply Priority setting for CSA: downscaled climate projections, regional climate outlook, prioritisation frameworks</p> <p>Incorporating livestock technologies and management practices into a broader climate-smart perspective</p> <p>CCAFS provides methods and research to estimate GHG emissions reductions, identifying priority options, and identifying the economic and policy incentives to encourage large scale adoption of mitigation and adaptation options.</p>	<p>Mainly through site integration, joint planning and implementation</p> <p>Joint resource mobilisation and financing of collaboration on research on GHG mitigation and adaptation options and use of climate information.</p>	<p>New climate smart options including livestock. Target countries: Burkina Faso, Mali, Ethiopia, Kenya, Indonesia and Vietnam.</p> <p>Outputs: Livestock specific GHG mitigation and adaptation options, including evidence about emissions reductions (data from developing countries); support to NAMA and NAPA processes (including livestock sector).</p> <p>Target countries: Global; Kenya, Ethiopia, Nicaragua, Tanzania,</p>

	Testing and promotion of options for adaptation of livestock systems to climate change.	Identification of options for adaptation of livestock systems to climate change.			Burkina Faso, Vietnam, Uganda, India.
WLE	<p>Development of strategies, tools and models to support the sustainable resilient intensification of major food systems. Identifying key attributes and monitoring indicators of sustainable intensification and resilience in different food production systems across scales. Regenerating degraded landscapes, including learning platforms to support the use of social (gendered) ecological-economic evaluations, and for global synthesis to ensure that CGIAR is aligned with monitoring of government restoration efforts, UNCCD land degradation neutral goals, and progress towards SDG's on land</p> <p>Developing conceptual system approaches and technical interventions to sustainably increase natural resource productivity in livestock-agro-ecological systems</p>	<p>Bringing the livestock lens to the sustainability and resilience agendas</p> <p>Forage technologies and livestock management for degraded land improvement.</p> <p>Identification of livestock management and feeding options for improved natural resource use efficiency.</p>	<p>Access to landscape scale sites,</p> <p>Testing options for taking forage improvement to scale across degraded landscapes.</p> <p>Testing of options and assessing cumulative impacts at landscape and higher scales.</p>	<p>Joint resource mobilization with support from W 1/ 2 for strategic analysis.</p>	<p>Outputs: New sustainability and resilience indicators at a range of scales. Strategies to support sustainability and resilience across scales.</p> <p>Target countries: Ethiopia , Tanzania, Kenya, Ghana, Burkina Faso and Niger</p> <p>Output: Joint advocacy on the land degradation agenda. Target countries: Ethiopia, Tanzania, Kenya</p> <p>Output: Conceptual approaches for improving sustainable water, land and biomass use in livestock systems. New technical and policy options for enhancing water productivity.</p>

					Target countries: Ethiopia, Tanzania, Burkina Faso, Ghana, Niger.
FISH ASF	<p>Research on Tilapia diseases.</p> <p>Joint development of value chain assessment and analysis toolkit that is applicable to perishable products, tested and evaluated at various sites</p>	<p>Bacterial disease diagnostics, molecular biology, livestock vaccines</p> <p>Provides methods for value chain assessment applicable to perishable products.</p> <p>Methods for assessing contribution of animal-source food in human nutrition</p>	<p>Coordinate epidemiological studies, support systematic sampling and offer expertise in aquatic epidemiology and fish diseases</p> <p>Joint development of the methodology; access to sites for joint analysis and learning</p> <p>Joint development of the methodology; access to sites for joint analysis and learning</p>	<p>Joint research mobilisation</p> <p>Joint resource mobilisation</p>	<p>Outputs: rapid diagnostic tools (based on metagenomics), simple immersion vaccines, Target countries: Egypt</p> <p>Identification of technological and institutional innovations to improve the performance of fish and livestock value chains, based on the assessments Target countries: Egypt</p>

Template 2b: Plans for site integration in CGIAR target countries

Target country (++ and + countries relevant to the Livestock CRP)	Define steps taken so far (March 2016) to establish national level engagement with other CRPs towards site integration	Define plan and schedule through which the Livestock AFS CRP will provide relevant elements for development of CGIAR site integration in this country
Ethiopia	<p>The Livestock CRP has been engaged at various levels in supporting the Ethiopia CGIAR country collaboration and site integration process. The process is led by ILRI, which is also the lead Centre for the Livestock CRP. A Livestock CRP focal point also participates on the coordination committee, as do focal points from the Livestock CRP partners: ILRI, CIAT, ICARDA, ICRAF and IWMI. The overall coordination committee represents 14 CGIAR Centres, 10 CRP focal points and the Genebank platform. This is the larger group that receives all communications on this process and meets quarterly for those who are based here to coincide with the existing Heads of Institutes meetings. This committee also helps with data collection (eg. mapping of ongoing projects in Ethiopia and baselining on the 10 principles of site integration). Out of this a smaller group of six (three Centres and three CRPs) was formed which meets more often to plan for meetings and the process in more detail with the help of ILRI Communications and Knowledge Management team which facilitates and helps capture the notes of meetings. At strategic points of the planning process, the Agricultural Transformation Agency and the Ethiopian Institute of Agricultural Research help the committee better prepare for the national consultation process.</p> <p>Some key activities to date include:</p> <ul style="list-style-type: none"> • Creating a database of major partners/collaborators. • Mapping CGIAR Centre and CRP work in Ethiopia (November 2015). Continuing to refine. • Engaging in partners' (ATA, RED&FS) national consultations on alignment to GTP II (November 2015 – January 2016). • Conducting National Consultation Meeting (11 December 2015). • Different CRPs/Flagships are conducting focus group consultations (January-March 2016). • Conduct focused group discussion with a target group of stakeholders (women and youth groups, farmers 	<p>The Livestock CRP team (ICARDA and ILRI) based in Ethiopia is participating in the CGIAR site integration working group which is led by ILRI. The Livestock team played an active role in the two site integration meetings convened so far. To facilitate the CRP's engagement in the process, Livestock CRP flagship teams have provided the focal points in Ethiopia an inventory of their tentative activities and workplans there starting in 2017. The focal points have been asked in particular to explore local collaboration with other CRPs on behalf of the flagships and communicate back to the flagship teams.</p> <p>The team in Ethiopia also convened a livestock-specific stakeholder consultation on February 9, 2016 at the ILRI campus in Addis to explore how the more specific CGIAR livestock agenda could align better with national priorities and initiatives.</p> <p>Elements described on p. 7-8 in the site integration guidance note that have begun to be addressed from the Livestock CRP perspective and how, are as follows (with examples):</p> <ul style="list-style-type: none"> ○ (element #2) The Livestock CRP team participated in the national stakeholder consultation held on 11 Dec 2015 and ensured that stakeholders from the livestock sector were well represented; the team also participated in the follow-up meeting of the CRPs focal persons on 16 February 2016. The Livestock CRP team has begun exchanging information on planned activities and targets sites with the other CRP focal points to work on the site integration plan for Ethiopia in the next meeting. ○ (elements #4,5) The Livestock CRP team has mapped the activities currently ongoing and planned for 2017 under W1&W2 and through W3/bilateral projects in Ethiopia and started to identify potential for joint activities with other

	<p>associations and others as agreed in the December 2015 meeting).</p> <ul style="list-style-type: none"> • Joining the Ethiopian Institute of Agricultural research in celebrating their golden jubilee through a series of seminars, technology exhibition and other high level ceremonies. • Creating a wiki for the coordinating committee. <p>On 11 December 2015 a national consultation was convened whose main objectives were to: 1. Improve understanding of the national priorities and goals for agricultural and related nutrition and health research for development; 2. Present CGIAR work in Ethiopia (major thematic areas, partnerships and geographic location); and 3. Identify major opportunities to align activities across actors around specific themes, including reviewing modalities for country collaboration. Participants were drawn mainly from the federal government departments, development partners (donors, NGOs) and very few private sector and farmer association groups. The meeting participants agreed that future meetings by CRPs should aim to include the wider stakeholders groups especially women and youth.</p> <p>The Roadmap for agricultural and economic growth in Ethiopia which spells out in the Government's vision was launched during the last quarter of 2015 through the Growth and Transformation Plan II (GTP II). The coordination committee will be working to align its programs to GTP II. In addition there are already major ongoing programs led by the Government like the Sustainable Land Management (SLM) in which the CGIAR is already a major player. Following the launch of GTP II there have been a number of national consultation meetings organised by several of CGIAR partners working on the alignment to GTP II. A good example are the meetings organised by the Agricultural Transformation Agency (ATA) and the Rural Economic Development and Food Security Sector Working Group (RED&FS) to discuss different pillars under GTP II. A number of CGIAR Centres participated in these consultations based on subject matter.</p> <p>The CGIAR national consultation focused on strengthening mechanisms of engagement and seeking ways to better align to national priorities. One of the key recommendations was the need to establish a joint CGIAR-national agricultural research system</p>	<p>CRPs; e.g. for target site-independent activities like promoting full purpose varieties in Ethiopia, entry points with the national crop breeding programs (barley and grain legumes with LDC; wheat and maize with the respective CRPs) are already identified; some joint activities of CRPs can be integrated through the Centres active in both CRPs, e.g. ILRI has a project on climate change adaptation in Borana in Ethiopia (CCAFS) which will be linked through the Livestock and the Environment Flagship as Borana is also a Livestock CRP target site. On Addis campus there is a well-established culture of CGIAR Centres working together in various combinations in a number of CRPs (Livestock and Fish, Drylands and Humid Systems) and larger bilateral projects; as well as cross-CRP integration like crop residue improvement through Dryland Systems and Livestock and Fish; these collaborations also promote effective use of complementary capacity of CGIAR staff (element #8).</p> <ul style="list-style-type: none"> ○ (element #6) The target sites for the planned W1/W2 activities and bilateral projects under the Livestock CRP still need to be mapped in detail to identify sites any overlaps with other CRPs and where identified joint activities can take place; however as the Livestock and Fish CRP in the small ruminant value chains will be continued as part of the Livestock CRP, these sites (spread over a number of agro-ecologies) and the former Humidtropics and Drylands systems sites in Ethiopia where Centres have already worked together are expected to provide good starting points. ○ (element #7) all CGIAR Centres in Ethiopia are hosted by ILRI on its campus and are using ILRI's administrative services. ○ (element #10) several joint consultations have been carried out under ILRI's leadership with national partners, e.g. CGIAR consultation with EIAR in December 2015; contributions to the golden jubilee of EIAR in February 2016; joint planning meetings for multi-Centre programs like the Feed the Future Innovation Lab in February 2016. ○ (element #8) The CGIAR Centres are using ILRI's administration to facilitate the principal government relationships.
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	<p>collaboration and communication mechanism. This mechanism, it was recommended, would establish a permanent secretariat for joint planning, sharing of findings, and monitoring and evaluation. The other areas of collaboration were: the development of joint research proposals, sharing of equipment and resources, streamlining policy engagement, and improving opportunities and modalities of capacity development. The need to facilitate access to laboratory facilities was also highlighted as key. These goals could be achieved through enhanced joint research implementation and supervision. This meeting was fully supported by ILRI and the Livestock and Fish CRP. When contacted, most Centres had no budgets to support this meeting, which only took place as ILRI asked every Centre and CRP to seek further clarification from DDGs, CRP Directors and the CO on the way forward. More details on the Ethiopia national consultations can be found on the GCARD3 website.</p> <p>Next steps: In its 16 February 2016 meeting, the committee reflected on the December meeting and the follow-up focused group meetings by individual CRPs. It further tried to clarify amongst the members what site integration means. It was agreed that so far the various CRP priorities were well aligned with those of the GTP II and ATA's priorities. This is very promising for upcoming collaboration. The committee agreed to purposely use the GTP II language in its engagements with the national processes and/or document through a flyer how CGIAR is contributing to GTP II.</p> <p>Furthermore it aims to identify what each CRP is seeing as the current situation and then the future situation in terms of site integration in Ethiopia from the perspective of the 10 elements which were highlighted in the guidelines, and to turn all that information into a narrative that also looks at collaboration initiatives and at ideas for future integration based on pipeline plans and projects. A day-long follow-up meeting is planned for a smaller group to synthesize this material and write the site integration plan. At the time this was discussed the level of detail the CO is expecting for the plan had yet to be clarified. The process of refining the mapping of CGIAR work in Ethiopia is to be continued.</p>	
Tanzania	The Tanzania CGIAR country collaboration and site integration process is coordinated by a CGIAR-Tanzania Site integration process group	The Livestock CRP team in Tanzania (ILRI and CIAT) is participating actively in the CGIAR Site Integration working group, and has shared

	<p>composed of representatives from: The Ministry of Agriculture, Livestock and Fisheries (3 persons), private sector (1), 11 CGIAR Centres which include Livestock CRP partners CIAT, ICRAF and ILRI based in Tanzania, 9 CRP focal points including the Livestock CRP, and the Genebank platform.</p> <p>From the national stakeholders' consultation workshop held in December 2015, principles of success and major opportunities for integration between and amongst CGIAR Centres, CRPs and national partners were identified to be: mutual trust, shared vision, shared rules of engagement, joint planning and clearly defined roles, transparency and accountability, flexibility, equal voice in partnership, comparative advantage and collective responsibility.</p> <p>To ensure alignment with the national agricultural priorities, both CGIAR Centres and CRPs have to understand the national strategies as elaborated in the Tanzanian Agricultural Sector Development Program (ASDP) Phase II. This implies that both CGIAR Centres and CRPs, when preparing proposals that include Tanzania, should ensure to access the ASDP documents for references so that where possible align the activities with the identified national priorities.</p> <p>IITA as lead Centre, in January 2016, was invited to participate in a five-day national ASDP prioritization workshop in which it worked closely with Ministry officials and other key stakeholders to identify key areas of focus by the country. The documents from this exercise were shared with the Livestock CRP focal point and circulated internally with the Livestock CRP for consideration when developing the draft CRP proposal. It is expected that before final submissions, certain NARS representatives will get an opportunity to provide input on the Livestock CRP proposal which include Tanzania to ensure alignment.</p> <p>The Centres are striving to jointly develop and implement projects that have multiple commodities and disciplines. An example we plan to emulate is that of Africa RISING project which although led by IITA, has other implementing Centres including ICRAF, CIAT, ILRI, and four others. These together with various national R4D partners in the country are demonstrating a good example of collaboration and integration. The Africa RISING project is using a common set of</p>	<p>information about program activities with the other working group members. The team participated in the national consultation in December 2015, and in February 2016 convened a livestock-specific consultation as a side event to the Tanzania Livestock Master Plan launch meeting. The CRP will continue the dairy value chain research initiated under the Livestock and Fish CRP.</p> <p>Co-location in the same premises at IITA EA Hub by Livestock CRP and other Site Integration focal points in Tanzania is facilitating coordination. ILRI and CIAT CRP leaders and Centre leaders have shared information as needed. The Livestock CRP focal point has been communicating with the Livestock CRP proposal development team to share the outcomes of the national consultation and to understand their plans for Tanzania.</p> <p>Elements described on p. 7-8 in the guidance note that are being addressed from the Livestock CRP perspective and how, are as follows (with examples) :</p> <ul style="list-style-type: none"> ○ (element #2) Livestock CRP participated in the national consultation held in December 2015. ○ (elements #4,5) In the 1st and 2nd quarters 2016, the group is planning to discuss and identify specific bilateral project or W1/2-funded activities planned in Tanzania as having potential for joint activities across CRPs. ○ (element #6) The group is also planning to discuss specific sites where the Livestock CRP overlaps with others. ○ (element #7) IITA EA hub in Dar es Salaam already houses the CRP team from ILRI among several other hosted Centres. The Livestock CRP team from ILRI and IITA staff have also been sharing the office provided to ILRI by Sokoine University of Agriculture in Morogoro. ○ (element #8) The CRP team from ILRI uses IITA staff at its EA hub in Dar es Salaam. ○ (element #10) There was good consensus on a way forward among CGIAR and national key players during the national consultation held in December 2015.
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	<p>research sites and staff from various Centres are participating in the implementation the project.</p> <p>Regarding the sharing of CGIAR facilities, the IITA Tanzania office already is hosting three CGIAR Centres, including ILRI. AGRA although not a CGIAR Centre is hosted by IITA. ICRAF and another Centre are located in the neighbouring areas which also makes it easy for consultation and effective use of the CGIAR facilities. The site integration process group will regularly communicate via emails and where possible organize meetings at least once every six months. Co-funding of these meetings will be explored. Plans are also under way to discuss the possibility of organizing a CGIAR-NARS national awareness workshop aimed at promoting to the new government our best-bet technologies for scaling up and out using the internally-sourced resources. This workshop will strategically target policy and decision-makers, private sector and other key players for resource mobilization. The selected technologies for popularization should have been tested and proven for potential to reach and impact millions of beneficiaries in Tanzania</p>	
Uganda	<p>The site integration process in Uganda is co-chaired by Bioversity International and CIP on a two-year rotational basis, with Bioversity starting in 2016. A steering committee involving all the eight CGIAR Centres present in Uganda which include CIAT, ICRAF, ILRI, and IWMI was formed and held its first meeting on January 27, 2016. At that meeting the 1st Consultation Stakeholder meeting was fixed for 9 March 2016. All Centres agreed to share the costs of the stakeholder consultation workshop.</p> <p>A second Steering Committee meeting was held on 11 February 2016, following which the chair and co-chair visited some key NARS stakeholders such as NARO-Uganda and Makerere University. The CIAT member consulted with the Uganda National Farmers' Federation, while the IWMI member consulted with teams in the Ministry of Finance. These consultation helped to collect secondary data and afforded the steering committee opportunities to interact with key stakeholders. The committee resolved that the first stakeholder workshop be co-hosted with the National Agricultural Research Organization (NARO) of Uganda in order to enhance ownership by national partners. The third Steering Committee meeting was held on 29 February 2016 and focused on plans for the</p>	<p>The Livestock CRP focal point in Uganda has been engaged in the steering committee involving all CGIAR Centres present in Uganda, and participated in the first three meetings held January 2016. The focal point liaises with the Livestock CRP flagship leaders and proposal writing team, sharing the outcomes of the meetings and receiving information about flagship plans.</p> <p>The focal point contributed to a joint CGIAR presentation at the stakeholder workshop on 9 March 2016. The Livestock CRP convened a joint consultation with key Ugandan stakeholders on the livestock CRP II proposal. The team has:</p> <ul style="list-style-type: none"> • Contributed to assembling a database of CGIAR major partners/collaborators in Uganda. • Collated and shared with the CGIAR site integration committee livestock-related documents that highlight national priorities in the livestock sector in Uganda. • Mapped research activities to the data base of CGIAR research work in Uganda. • Shared a summary of its pig value chain work in Uganda. Highlights from this work will be used to demonstrate the

	<p>implementation of the Stakeholder Consultation workshop; drew up the program, agreed on the discussion issues and the details of workshop outputs.</p> <p>Other staff members from the CRP working in Uganda are email-looped into all communications regarding the CGIAR site integration process right from the start. The committee will hold brief internal consultations to discuss issues on the structure and content of meeting agendas and work through consensus. Minutes from these meetings are shared to all members of the steering committee through whom information is shared with respective Centre teams. In addition the committee is collecting information from partners and stakeholders and hopes to build this information into sharable data about CGIAR sites.</p> <p>Materials collected so far include:</p> <ul style="list-style-type: none"> • CGIAR major partners/collaborators in Uganda. • Documents that highlight national development priorities in Uganda. • CGIAR research work in Uganda. • Individual project activities. <p>The CGIAR site integration committee has so far not reached a stage of discussing potential bilateral project or W1/2-funded activities planned in Uganda for joint activities amongst CRPs. However, in the discussions, the committee has noted that for several CRPs operational in Uganda, there are already several clusters of Centres collaborating in one or more of the CRPs and sharing sites among themselves and with NARS. The Humidtropics Uganda action sites of Mukono-Wakiso and Kiboga-Kyankwanzi field sites seem to be common sites in which many CGIAR Centres are currently working including ILRI, ICRAF, CIAT and others. Furthermore, it was noted that Centres were already sharing laboratory facilities along with NARO-Uganda institutes.</p> <p>The workshop on 9 March 2016 will lay the foundation for a long term engagement between the CRPs and Ugandan partners and stakeholders. The intention at this stage is not to come up with a complete work plan/site integration plan during the actual meeting but to really listen to and discuss with partners and stakeholders</p>	<p>work that the CGIAR is doing Uganda in a joint presentation that will be given by a representative of the CGIAR Centres.</p> <p>The CGIAR site integration committee is planning to discuss potential bilateral project or W1/2-funded activities planned in Uganda for joint activities amongst CRPs. The Uganda livestock CRP team has identified the following potential activities for collaboration with other CRPs</p> <ul style="list-style-type: none"> • Building on existing collaboration on the CIP-led project on 'Expanding Utilization of Root and Tuber Crops and reducing their Post-harvest losses'. The Livestock and Fish CRP leads an activity on 'Improving the Utilization of Sweetpotato and other Root and Tuber Crop Residues for Pig Feeds in Uganda' • Building on existing collaboration with IITA on a project 'Equitable Nutritional and Income options in Urban and Rural settings of Humidtropics Uganda Action Site' <p>The mechanism to enable overall collaboration between CGIAR entities—not just Centres but also CRPs— needs to be addressed very early on in the process. Much more thinking needs to be put into defining the common interest of the different Centres to act collectively in Uganda. A document that defines common business plan (or shared value proposition) and define guiding principles for the steering committee might be useful. Funding mechanisms that stimulate collaboration need to be thought through as well. This will be piloted and evolve over time.</p> <p>It was agreed by the steering committee that the initial focus will be on initiating dialogue and engagement with partners and stakeholders to understand and align with the national priorities and actions and to establish and maintain partnerships. Going forward the committee will then begin to address other elements including implementing site integration plans. Having a 'single focus' communication such as 'Uganda Country Consortium' website or set up a wiki page to enhance communication between CGIAR Centres and also key stakeholders and partners is under consideration.</p>
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	about the development priorities for Uganda; what the various stakeholders and partners are doing themselves to meet those priorities and goals; and exploring what the opportunities are for partnership, alignment and working together towards these goals. The outputs of the meeting will guide the development of CGIAR site integration plans while informing the CRP II process.	
Kenya	ICRAF leads the site integration process. An initial inventory of Centre and CRP activities has been undertaken, and meetings of the Centre and CRP representatives were held on 12 February and 4 March 2016. A national consultation was held at the ICRAF campus in Nairobi on 9-10 March 2016.	The Livestock CRP team (ILRI and CIAT) is participating actively in the CGIAR working group, and has shared information about program activities with the other working group members. In February a livestock-specific consultation was convened at the ILRI campus in Nairobi. The CRP received feedback on its plans to initiate its approach in the dairy and beef value chains; additional legacy sites associated with the Humidtropics and Drylands systems work are also being evaluated. The Livestock CRP focal point participated actively in the national consultation. The focal point is compiling information about ILRI, CIAT and ICRAF capacities and activities in Kenya in preparation for follow-up meetings of the CGIAR working group to address the other elements of the site integration guidance.
Nicaragua	<p>For Nicaragua, a steering committee was established with a representative from CIAT and ICRAF, together with others from three other Centres/CRPs. As the first priority, a national consultation was held in Managua, Nicaragua from 17-18 November, 2015. Participants included CIAT and ICRAF and four other CGIAR Centres, as well as CATIE and CIRAD and several national partners, including representatives of the national government, regional government, academic institutions, producer associations, national and international NGOs and cooperatives. Centres represented work of nine CRPs (from Phase 1) which are active in the region, including the Livestock and Fish CRP. Opportunities for further CRP integration were identified, including shared goals, activities, partnerships that would benefit the work being carried out by each program in Nicaragua and a proposed theory of change and impact pathway to carry them out. CIAT covered expenses related to the venue and food, while each participant assumed the cost of their travel and other incidental expenses.</p> <p>With guidance from the Consortium Office, the steering committee will draft the site integration plan building on the national</p>	<p>Livestock as one of the leading CRPs in Nicaragua has participated in all stages of the site integration process so far. The Livestock focal point participated in the national consultation, and is following up on development of the country plan. The CRP will continue the dual purpose cattle (dairy-beef) value chain research initiated under the Livestock and Fish CRP.</p> <p>All national CRP staff members have participated or otherwise been involved in the national consultation event, and they contributed to the document produced as a result. Ideas have been exchanged with other CRP leaders and representatives (e.g., Humidtropics, CCAFS), and with Livestock Flagship leaders and representatives on key second phase components. Besides this, key non-CGIAR Livestock CRP partners participated and contributed.</p> <p>Next steps include :</p> <p>March 2016: Interaction with specific Livestock CRP stakeholders</p> <p>March 2016: Interaction with other CRPs active in Nicaragua (A4NH, CCAFS, FTA, PIM, WLE) on second phase integration</p>

	<p>consultation and past/current experiences of Centres in Nicaragua. A clear understanding of what is being proposed in Phase 2 CRP proposals is important before any further stakeholder consultation is conducted. Potential sites of integrative work were identified based on previous and ongoing CGIAR efforts (such as CCAFS climate-smart village (CSV) and FTA sentinel sites) and on priorities of the government (such as the dry corridor). Some integrative work has been already done in Tuma La Dalia CSV between CCAFS and FTA regarding baseline surveys and implementation of agroforestry measures. Developing information and knowledge management systems are essential to sustain dialogue and communication. Unlike other countries, Nicaragua is not anticipated as being a physical hub leading to a single CGIAR office. To meet donor/CGIAR aspirations on site integration, dedicated funding to support coordination and collective efforts are required.</p>	<p>Feb-Dec 2016: Interaction with CRP Humidtropics on integrating elements into Livestock</p> <p>April 2016 onwards: In collaboration with the other CRPs, and based on the Livestock and Fish CRP experiences, preparation of a working document on livestock including the following themes: country context and priorities, CGIAR research agenda, theory of change and impact pathway, strategies on CRP second phase coordination, resource mobilization, scaling.</p> <p>In the case of PIM the Livestock CRP team expects to continue making good use of the methodological approaches and tools for the development of value chains and inclusion of smallholder producers in formal markets; in the case of FTA, a main common theme is the functional diversity of trees in livestock farms, and ecosystem services; and the relation with CCAFS will be strengthened to integrate livestock production in research strategies and approaches related to climate-smart agriculture.</p> <p>Livestock activities will continue to focus on the main cattle producing regions in the central (Camoapa (department of Boaco) and Matiguás (department of Matagalpa)) and Caribbean parts of the country. The presence in the north (Estelí and Condega) will be consolidated, mainly through the integration of activities presently still under with Humidtropics.</p> <p>The activities of the Livestock CRP will largely be based on the current Livestock and Fish CRP with a strong emphasis on value chain work (dual purpose cattle) and the CIAT LivestockPlus concept with emphasis on sustainable livestock production, forages for ecosystem services—the latter with a strong link to WLE work on recuperating degraded soils. As a continuation of the already initiated integration of Humidtropics concepts like learning alliances / R4D-innovation platforms in the Livestock and Fish CRP, the following is being proposed:</p> <ul style="list-style-type: none"> • Development and implementation of crop-livestock-tree related work in the current Humidtropics territorial alliances. • Implementation of the territorial learning alliance and innovation/R4D platform concepts for technology development to the current Livestock and Fish intervention sites.
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		<ul style="list-style-type: none"> Integrating value chain work of both CRPs, with a strong emphasis on gender. Combine the work on scaling mechanisms of both CRPs. <p>Based on the on-going work and already existing links with Livestock and Fish, the Livestock CRP expects to continue with the major part (60%) of the activities currently under Humidtropics.</p>
Vietnam	<p>Nine CRPs and ten Centres participated in the Vietnam planning for CGIAR country coordination. A national stakeholders' consultation workshop was organized in December 2015, with over 70 participants representing: 1) research institutes and government agencies, 2) universities, 3) NGOs-private sector agencies and associations, 4) international organizations and donors, and 5) CGIAR staff.</p> <p>Stakeholders agreed on an eco-regional framework to facilitate in-country collaboration and site integration. The target regions are: 1) Northwest, 2) Northeast, 3) Red river delta, 4) North central coast, 5) Central highlands-south central coast and southeast, and 6) Mekong river delta. In addition, integrating CRPs with national and local development plans was considered a key dimension of country collaboration. For each region, the stakeholders identified: 1) development priorities as set by government policymakers/decision-makers, 2) key research gaps which are recommended for the CGIAR to address, and 3) potential partners for specific research and development initiatives.</p> <p>Between December 2015 and March 2016, CRPs/Centres also engaged in bilateral discussions on specific collaboration needs and opportunities. Several CRPs also organized their respective country/regional planning and consultation events.</p> <p>A follow-up meeting by the CGIAR Vietnam team was held on 7 March 2016, with eight CRPs—including Livestock CRP—and seven Centres represented. The eight participating CRPs re-confirmed that Vietnam is a target country for CRP Phase 2 proposals. As next step, it was also agreed that subnational targeting will be undertaken for higher-resolution site integration plans, i.e. within each agro-ecoregion. A draft agenda for the 10-element site integration report was prepared. The proposed action items are to be shared with CRPs, for them to indicate their suggested priorities as well as intent for co-financing/cost-sharing.</p>	<p>The Livestock CRP is represented by the current Livestock and Fish CRP Value Chain leader in Vietnam. She has participated in two coordination meetings to date. A national consultation on site integration was held in Hanoi, Vietnam on 14-15 December to discuss key activities of the CGIAR with in-country partners in Vietnam. The aim was to understand national priorities and to explore how these can be aligned with the collective aims of CRPs and Centres in the country. A second meeting was held on 7 March 2016 to discuss the site integration plans and participated in by CRP/CGIAR Centre focal points to discuss the site integration plans for Vietnam. In between these meetings, virtual communication facilitated interaction to seek inputs, as well as to provide updates of next steps and upcoming activities. The focal point will continue to participate in these engagements as needed.</p> <p>The focal point is making use of the site integration meetings to communicate and provide updates to other CRPs/CGIAR Centres about the Livestock CRP proposal. Internally within ILRI, the focal point receives regular updates and other information from the CRP director/ILRI management that guide country-level interaction with other CRPs/Centres. Through participation in the various meetings organized for site integration consultation and planning, the team has contributed to the ongoing dialogue and engagement with partners and stakeholders in Vietnam. The Livestock CRP is also making a commitment to support the site integration process by allocating from its budget USD 5000 per year for this activity. A stakeholder consultation on the Livestock CRP Phase 2 proposal is being considered to solicit inputs to the further refinements of the proposal, preferably as a side activity in a national partner's workshop and/or stakeholder meeting.</p> <p>The CRP has an ongoing bilateral project with A4NH and local partners in Vietnam, and seed funding provided by the Animal Health Flagship</p>

	<p>The country collaboration/site integration efforts in Vietnam is coordinated through: 1) a core team with representatives from CRPs/Centres having physical (office) presence in Vietnam, and 2) a working group with representatives from all CRPs/Centres planning to undertake activities in Vietnam for CRP Phase 2. CIAT provides overall leadership, with ICRAF as co-lead Centre. In each eco-region, a lead Centre and supporting CRP/s have also been identified and agreed upon.</p>	<p>to support complementary field activities and analyses. With support from the Livestock CRP grant, we have implemented a cross-CRP scoping study involving Livestock, A4NH and Humidtropics. These ongoing cross-CRP collaboration engagements facilitate alignment of research activities and generation of joint research outputs and public goods. The Livestock CRP sites in Vietnam also overlap with sites where other CRPs work or intend to work; specifically, we are already working in the same agro-ecological region/provinces with A4NH, Humidtropics, CCAFS, FTA, RTB, thus providing better opportunities to explore shared resources and field facilities and a more coordinated engagement with partners. There are apparent synergies from working with FTA in the Northwest region on utilization of biomass from fodder trees for feed as well as broader systems issues on land use change in response to increasing demand for livestock, with RTB and CCAFS in the Northcentral coast and Central Highlands of Vietnam on exploring feeds and fodder options from available crops and forage species, and with A4NH on animal health risks and food safety in informal markets in the Red River Delta, Northcentral Coast, and the Central Highlands. Collaboration in national/regional/global modelling for foresight analysis also appeared as an area of common interest among the CRPs in Vietnam, as well as cross-cutting work on gender, systems analysis, and in developing common tools and approaches for M&E and impact assessment. The next steps will need to identify options for operationalizing these shared opportunities including joint resource mobilization efforts.</p> <p>Of the five flagships in the Livestock CRP, four (Livestock Health, Livestock Feeds and Forages, Livestock and the Environment, and Livestock Livelihoods and Agri-food Systems) have explicitly indicated ongoing and/or planned activities in Vietnam, funded from bilateral grants and/or W1/2 funds. With a more structured mechanism now in place for the CRPs and Centres to coordinate their work in Vietnam, through the proposed agro-ecological teams, there is more opportunity to develop joint concept notes and proposals for resource mobilization.</p>
Burkina Faso	<p>A process for CGIAR site integration in Burkina Faso was initiated with the June 2013 meeting of WLE, FTA and CCAFS in Bonn which agreed to explore areas of cross-CRP synergy (both issue and place-based). All</p>	<p>The site integration process has built on the previous stakeholder engagements and consultations that took place between 2013 and 2014. ILRI/Livestock and Fish CRP participated in a couple of these meetings organized by CIFOR and specifically provided information on</p>

	<p>three CRPs had major new research programs in this country, and there was potential to link to CRP Drylands.</p> <p>On 24 August 2013, CIFOR organized a first internal meeting between ICRAF and CIFOR in Ouagadougou to review the expected outcomes of the CRPs' joint initiative in Burkina Faso. A committee was set up at this meeting and was tasked to establish a database of CGIAR projects in terms of targets, location, and partners that would be a basis for discussing improved coordination, but also for joint development of new projects.</p> <p>A second meeting was convened in December 2013 in Ouagadougou with participation of a broader set of partners in Burkina Faso (CRPs FTA, CCAFS, WLE, Drylands, national and other international research institutions, including universities, state and non-state development partners, international NGOs) to review the quality of previous partnerships with CGIAR initiatives in Burkina Faso and to work out a new partnership framework guided by the aim to contribute to the same development pathways in Burkina Faso in a synergetic manner.</p> <p>A third meeting was held in February 2014 with the same set of partners to define a vision, mission and action plan for the partnership framework. It was also agreed to develop a common theory of change aligned to the strategy for accelerated growth and sustainable development of Burkina Faso (SCADD), particularly the national program for the rural sector (PNSR). The outputs of this meeting were validated by CRPs Leaders.</p> <p>As part of the agreed roadmap, the CGIAR-led initiative to build a thematic and geographical database of all CGIAR projects and those of non-CGIAR actors working in the rural sector of Burkina has been merged with a similar initiative led by the SP/CPSA (Permanent Secretariat for Coordination of Agricultural Sectoral Policies) for setting up a map-based database of government and development partners' interventions in the areas of rural development in Burkina Faso.</p> <p>The CRPs' joint initiative in Burkina Faso has also partnered with the CCAFS Scenarios program and the SP/CPSA in a specific process aimed at examining the ending PNSR in the context of multiple socio-</p>	<p>sites where ILRI had CRP activities as at the time, particularly Dryland Systems and WLE, and an ILRI-led bilateral project (CPWF Volta basin).</p> <p>The database on sites for CRPs and bilateral project activities in Burkina Faso provided important information for site selection when Livestock CRP and Fish was moved from Mali to Burkina Faso. There has not been any recent stakeholder consultation on CRP site integration from the discussion with the Centre lead person for Burkina Faso but he indicated there may be one after the review of the report of previous consultations. Plans are yet to formulated and agreed, therefore, for coordinating the Livestock CRP engagement in the country as part of a common site integration plan. In the meantime, the Livestock CRP focal point is liaising with the CRP flagship leaders to consolidate the CRP planning in anticipation of the site integration coordination activities.</p>
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	<p>economic and climatic scenarios, to improve its robustness, flexibility and feasibility in the face of possible diverse futures. This scenario-guided policy revision workshop, held in July 2015, offered a unique opportunity to CGIAR experts (FTA, CCAFS, Drylands, WLE) and national policy-making experts and all other workshop participants to identify research areas through which CRPs and CGIAR Centres can contribute to the expected outcomes of the upcoming revised PNSR.</p> <p>Overall, these joint initiative in Burkina Faso has set up and followed until now a self-initiated participatory approach involving CGIAR actors (CRPs and Centres), national actors of Burkina Faso, and other international actors intervening in Burkina Faso, to frame partnership, map research interventions and define development and research priorities to be considered for the rural development of Burkina Faso.</p>	
India	<p>Agriculture's strong contribution of Indian agriculture has been made possible by an exceptionally strong National Innovation System that includes the Indian Council of Agricultural Research (ICAR), National and State science agencies and universities, a large NGO sector and a growing private sector. Agricultural research in India has also contributed to and benefited from excellent international collaborations. The CGIAR has a long presence and history of collaboration in India, the with ICRISAT headquartered in Hyderabad, Telangana State and most of the CGIAR Centres and CRPs having Regional Centres and staff based in India.</p> <p>Each year, ICAR hosts an annual coordination meeting of all CGIAR Centres in India to consult on ongoing and proposed research initiatives. The annual meeting in 2016 was held on 19 January in New Delhi and attended by all CGIAR Centres. Meeting minutes are posted at http://gcard3.cgiar.org/india/. In addition, ICAR also hosts annual planning meetings with most CGIAR Centres during which joint research projects are reviewed and planned. Hence, CGIAR research in India is already well coordinated with the main research partner in India, ICAR.</p> <p>Specifically, in developing the CRP Phase 2 Site Integration Plan for India, a Steering Committee of representative CGIAR leaders was formed on 19 January 2016 and held its first face-to-face meeting on 23 February 2016. In preparation for this meeting, a spreadsheet of</p>	<p>The Livestock CRP team in India is led by an ILRI focal point and is participating actively in the CGIAR steering committee, and has shared information about program activities with the other working group members. The focal point participated in the national consultation, and is following up on development of the country plan. The CRP is reviewing whether it will continue its dairy value chain research initiated under the Livestock and Fish CRP; specific plans are therefore not yet available.</p>

	<p>current CGIAR research in India was created and these data have subsequently been mapped across all Indian States and agro-ecological zones. The steering committee agreed to a consultation process and the relative budget, contributions, agenda and local arrangements for this engagement. All Centres also contributed a five-page description of their research in India as a communication resource for partners.</p> <p>The India Consultation Meeting is planned to be held in New Delhi on Tuesday 22 March 2016. Over 130 CGIAR stakeholders are invited. The meeting objectives are:</p> <ul style="list-style-type: none"> • Review current CGIAR research in India; • Present the planning for Phase 2 CGIAR CRPs; • Seek input from partners in India on the CRP plans; • Submit consolidated feedback to CRP and CGIAR Centres; and • Commit to on-going consultation with partners in India. <p>Next Steps: Outputs from India Consultation meeting will form the basis of the Site Integration plan for India. The SC will meet on 23 March to develop version 1.0 of this plan. Ongoing SC meetings are to be held quarterly (four per year) in Delhi.</p>	
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Annex 3.7 Staffing of management team and flagship projects

CRP Director

Name: Tom RANDOLPH

Current position and affiliation: Director, CGIAR Research Program on Livestock and Fish, International Livestock Research Institute (ILRI)

Profile: An agricultural economist, he has been a researcher in the CGIAR for nearly 25 years. Since joining ILRI in 1998, his research interests have been mainly related to animal health economics, human nutrition and health impacts, and other social science dimensions of livestock development mainly focused in sub-Saharan Africa. He has led the Livestock and Fish CRP since its inception.

Employment:

1992-1994, Rockefeller Social Science Research Fellow in Agriculture, West Africa Rice Development Association (WARDA), Saint Louis, Senegal

1994-1998, Policy economist and Program leader, WARDA, Bouaké, Côte d'Ivoire

1998-2003, Animal health economist and scientist, International Livestock Research Institute (ILRI), Nairobi

2000-2013, Post-doctoral scientist, Market-Oriented smallholder dairy project, International Livestock Research Institute, Nairobi

Education:

1992, PhD in Agricultural Economics with a minor in Human Nutrition, Cornell University, USA

1986, MSc in Agricultural Economics, Cornell University, USA

Selected Recent Peer-reviewed publications:

- Lapar L, Nguyen T, Zou C, Liu J, Li X, and Randolph T. (2012) Assessing the impact of feed technology adoption by smallholders in sweet potato-pig systems in Sichuan, China. *Asian Journal of Agriculture and Development. Special Issue: Proceedings of the 7th Asian Society of Agricultural Economists (ASAE) International Conference*, 9(3):66
- Métras R, Stevens KB, Abdu P, Okike I, Randolph T, Grace D, Pfeiffer DU and Costard S. (2012). Identification of Potential Risk Factors Associated with Highly Pathogenic Avian Influenza Subtype H5N1 Outbreak Occurrence in Lagos and Kano States, Nigeria, During the 2006–2007 Epidemics. *Transboundary and Emerging Diseases*. doi: 10.1111/j.1865-1682.2012.01322.x
- Mungube EO, Diall O, Baumann MP, Hoppenheit A, Hinney B, Bauer B, Sanogo Y, Maiga B, Zessin KH, Randolph TF, Clausen PH. (2012). Best-bet integrated strategies for containing drug-resistant trypanosomes in cattle. *Parasit Vectors*. 2012 Aug 8; 5(1):164.
- Clausen P-H, Bauer B, Zessin K-H, Diall O, Bocoum Z, Sidibe I, Affognon H, Waibel H, Grace D, Randolph T. (2010). Preventing and Containing Trypanocide Resistance in the Cotton Zone of West Africa. *Transboundary and Emerging Diseases* 57:28–32.
- Affognon HD, Randolph TF and Waibel H. (2010). Economic analysis of animal disease control inputs at farm level: the case of trypanocide use in villages under risk of drug resistance in West Africa. *Livestock Research for Rural Development*. 22, Article #224. <http://www.lrrd.org/lrrd22/12/affo22224.htm>
- B. Bett, T.F. Randolph, P. Irungu, S.O. Nyamwaro, P. Kitale, J. Gathuma, D. Grace, G. Vale, J. Hargrove, J. McDermott. (2010). Field trial of a synthetic tsetse-repellent technology developed for the control of bovine trypanosomiasis in Kenya. *Preventive Veterinary Medicine* 97:220–227.

- Grace D, Randolph T, Affognon H, Dramane D, Diall O, Clausen P-H. (2009). Characterisation and validation of farmers' knowledge and practice of cattle trypanosomosis management in the cotton zone of West Africa. *Acta Tropica* 111:137-143
- Randolph T.F., Schelling E., Grace D., Nicholson C., Cole D., Omoro A., Dement M., Leroy J., Zinsstag J., Ruel M. (2007). The role of livestock in human health and nutrition for poverty reduction in developing countries. *J Animal Science* 85:2788-2800.
- Randolph T., Perry B., Benigno C., Santos I., Agbayani A., Webb R., Gleeson L. (2002). The economic impact of foot and mouth disease and its control in the Philippines. *OIE Revue Scientifique et Technique* 21 (3):645-661.
- Randolph T.F., Kristjanson P.M., Omamo W.S., Odero A.N., Thornton P.K., Reid R.S., Robinson T., Ryan J.G. (2001). A framework for priority setting in international livestock research. *Research Evaluation* 10(3):142-160

Other Evidence of Leadership, large-program management and delivery: PI on major international multi-partner research projects on trypanocide resistance in West Africa and avian influenza in Africa and Asia. Research program leader at WARDA and ILRI before taking leadership of a CGIAR Research Program.

Role in Livestock CRP: Director

Flagship leaders

Name: Olivier HANOTTE

Current position and affiliation: Principal Scientist, International Livestock Research Institute (ILRI) and Professor of Population and Conservation Genetics, University of Nottingham

Profile: Hanotte has led a series of ground-breaking research programs examining fundamental aspects of livestock origin, diversity and adaptation both in Africa and Asia. The central theme of his research is the understanding at the genome level of the genetic adaptations of “tropical” livestock to their production environments and their use in breeding improvement programs. He studies both livestock population selected intensively by human (productivity traits) as well as indigenous population under natural selection (e.g. disease resistance traits) using genome-wide approaches (e.g. next generation sequencing and high-density genome-wide SNP chips microarray genotyping). A major baseline element of his work is the understanding of the origin and history of livestock species and animal genetics resources diversity characterization is an important component of this work.

Employment:

2009 – 2015, Professor of Population and Conservation Genetics, University of Nottingham

2009 – 2010, Director, Frozen Ark

1995 – 2008, Senior Scientist, International Livestock Research Institute

1991 – 1995, Post-doctoral Research Associate, University of Leicester

Education:

1991, PhD in Zoology, Université de Mons-Hainaut, Belgium and University of Leicester

1984, Agrégation de l'Enseignement Secondaire Supérieur, Université de Libre de Bruxelles

Selected Recent Peer-reviewed publications:

- Hussain Bahbahani, Harry Clifford, David Wragg, Mary N Mbole-Kariuki, Curtis Van Tassell, Tad Sonstegard, Mark Woolhouse and Olivier Hanotte. 2015. Signatures of positive selection in East African Shorthorn Zebu: A genome-wide SNP analysis. *Scientific Reports* 5: 11729. <http://dx.doi.org/10.1038/srep11729>
- Mwacharo, J.M., Nomura, K., Hanada, H., Han, J.L., Amano, T. and Hanotte, O. 2013. Reconstructing dispersal patterns of village chickens across East Africa: insights from autosomal markers. *Molecular Ecology* 22: 2683-2697.
- Hanotte, O., Dessie, T. and Kemp, S. 2010. Time to tap Africa's livestock genomes. *Science* 328: 1640-1641.
- Hanotte O., Bradley D. G., Ochieng J., Verjee Y., Hill E.W. and Rege J.E.O. 2002. African pastoralism: genetic imprints of origins and migrations. *Science* 296: 336-339.
- Hanotte O., Y. Ronin, Agaba M., Nilsson P., Gelhaus A., Horstmann R., Sugimoto Y., Kemp S., Gibson J., Korol A., Soller M. and Teale A. 2003. Mapping of QTL controlling resistance to trypanosomosis in African indigenous cattle. *PNAS* 100: 7443-7448.

Scientific management and leadership: His research group at the University of Nottingham currently includes 5 international PhD students, one visiting scientist from Japan and one post-doctoral scientist. Funding is provided by the Biotechnology and Biological Sciences Research Council, the UK Department for International Development and FAPESP – Sao Paulo Brazil. Ongoing active scientific collaborations with following institutions: the International Center for Agricultural Research in the Dry Area, University of Edinburgh, Universidade Estadual Paulista – UNESP, Brazil.

Role in Livestock CRP: Leads the Livestock Genetics Flagship

Name: Ulf MAGNUSSON

Current position and affiliation: Professor of animal reproduction, Swedish University of Agricultural Sciences (SLU)

Profile: Magnusson's areas of research and teaching are livestock reproduction, infectious diseases affecting reproduction including zoonoses especially in low-income countries. He was formerly member of the Swedish Government-FAO committee, is member of the guiding group of the Global Agenda for Sustainable Livestock, and member of the Sida reference group for Swedish support to CGIAR. He has a PhD in veterinary medicine (obstetrics and gynaecology).

Employment:

1999-2005, Director, Uppsala University and Swedish University of Agricultural Sciences

1993-2016, Various academic, professor since 2005, Swedish University of Agricultural Sciences

1992, post doc, University of Guelph

Education:

1990, PhD, Swedish University of Agricultural Sciences

1982, DVM, Swedish University of Agricultural Sciences

Selected Recent Peer-reviewed publications:

- Lindahl, E., Sattorov, N., Boqvist, S. and Magnusson, U. 2015. A study of knowledge, attitudes and practices relating to brucellosis among small-scale dairy farmers in an urban and peri-urban area of Tajikistan *PLOS ONE* 10: e0117318
- Osbjer, K., Boqvist, S., Sokerya, S., Kannarath, C., San, S., Davun, H. and Magnusson, U. 2015. Household practices related to disease transmission between animals and humans in rural Cambodia. *BMC Public Health*. 15(1):476.
- Benon, K.M., Owiny, D.O., Båge, R., Nassuna-Musoke, M.G., Humblot, P. and Magnusson, U. 2015. Managerial practices and factors influencing reproductive performance of dairy cows in urban/peri-urban areas of Kampala and Gulu, Uganda. *Acta Veterinaria Scandinavica* 57: 35.
- Magnusson, U. and Bergman, K.F. 2014. Urban and peri-urban agriculture for food security in low-income countries – Challenges and knowledge gaps. SLU-Global Report 2014:4. Uppsala: Swedish University of Agricultural Sciences.
- Öborn, I., Bengtsson, J., Hedenus, F., Rydhmer, L., Stenström, M., Vrede, K., Westin, C. and Magnusson, U. 2013. Scenario development as a basis for formulating a research program on future agriculture - livestock, crops and land use: A methodological approach. *Ambio* 42: 823-39.
- Lindahl, J., Stahl, K., Chirico, J., Boqvist, S.; Thu, H.T.V. and Magnusson, U. 2013. Circulation of Japanese Encephalitis Virus in pigs and mosquito vectors within Can Tho City, Vietnam. *PLOS Neglected Tropical Diseases* 7: e 2153.

Other Evidence of Leadership, large-program management and delivery: Director for Centre for reproductive biology in Uppsala (network of 100 scientists at two universities) (5 years); Vice dean responsible for research and international cooperation at the Faculty for Veterinary Medicine and Animal Science, SLU (about 50 full professors at 6 departments) (3+3 years); Head of division of Reproduction SLU (about 30 academic staff) (5 years); Program manager for research program in reproductive toxicology (10 senior scientist +20 PhD students at 5 universities) (5 years); President of Association for Institutions for Tropical Veterinary Medicine (AITVM); Coordinator of Bilateral cooperation SLU - Makerere University (About 20 scientists involved) (5 years); Currently program director (30% FTE) for AgriFose2030 Agriculture for food security – translating science into policy and development (about 15 staff at 4 universities/institutes)

Role in Livestock CRP: Leads the Livestock Health Flagship

Name: Michael PETERS

Current position and affiliation: Program Leader, Tropical Forages, CIAT

Profile: Peters has worked for 3 decades in the area of tropical forages commencing in Congo DRC, then Nigeria with ILCA/ILRI and since 1998 with CIAT in Colombia. While at CIAT, he has focused on integrating research on tropical forage genetic resources and natural resource management, with a strong emphasis on linking farmer-led and scientist-led research and development approaches, expert systems for selecting forage options to different biophysical and socio-economic environments, linking farmers to markets, and innovative systems. More recently, he and his team have been assessing the potential of tropical forages to mitigate greenhouse gas emissions. He has ample experience in working in multidisciplinary and multicultural teams, contributing to or leading fund raising, design, execution, management, and documentation of multiple agricultural research projects. He has published about 150 papers, booklets, extensions materials, posters, tools of which about 50 are published in peer reviewed journals. He currently coordinates CIAT's global Tropical Forages Program with about 60 staff in Central America and the Caribbean, Eastern and Central Africa and Southeast Asia, is part of the Management team of the Livestock and Fish CRP and serves on the Editorial board of the Tropical Grasslands-Forrajes Tropicales journal.

Employment:

1998-2007: Research Scientist, Tropical Forages, CIAT, Colombia

1992-1996: PostDoc, Tropical Forages, ILRI, Nigeria

Education:

1992, Doctor of Science: Agronomy, University of Giessen, Germany

1988, Diplom (equivalent to MSc): Agronomy, University of Giessen, Germany

Selected Recent Peer-reviewed publications

- Rao, I.M. et al. 2015. LivestockPlus – The sustainable intensification of forage-based agricultural systems to improve livelihoods and ecosystem services in the tropics. *Tropical Grasslands – Forrajes Tropicales* 3: 59-82.
- Andersson, M.S., Schultze-Kraft, R., Peters, M., Hincapié, B. and Lascano, C.E. 2005. Morphological, agronomic and forage quality diversity of the *Flemingia macrophylla* world collection. *Field Crops Research* 96: 387-406. [http://dx.doi.org/ 10.1016/j.fcr.2005.09.002](http://dx.doi.org/10.1016/j.fcr.2005.09.002)
- Torres, J., Muñoz, L.S., Peters, M. and Montoya, C.A. 2013. Characterization of the nutritive value of tropical legume grains as alternative ingredients for small-scale pork producers using in vitro enzymatic hydrolysis and fermentation. *Journal of Animal Physiology and Animal Nutrition* 97: 1066-1074. <http://dx.doi.org/10.1111/jpn.12015>
- Cook, B.G., Pengelly, B.C., Brown, S.D., Donnelly, J.L., Eagles, D.A., Franco, M.A., Hanson, J., Mullen, B.F., Partridge, I.J., Peters, M. and Schultze-Kraft, R. 2005. Tropical forages: An interactive selection tool. Brisbane, Australia: CSIRO, Queensland, Australia: Department of Primary Industries and Fisheries, Cali, Colombia: CIAT and Nairobi, Kenya: ILRI. www.tropicalforages.info.
- Peters, M., Lascano, C.E., Roothaert, R., Haan, N.C. de. 2003. Linking research on forage germplasm to farmers: The pathway to increased adoption – a CIAT, ILRI and IITA perspective. *Field Crops Research* 84: 179–188. [http://dx.doi.org/10.1016/s0378-4290\(03\)00149-7](http://dx.doi.org/10.1016/s0378-4290(03)00149-7).

Other Evidence of Leadership, large-program management and delivery:

Strong fund raising record, center representative Systemwide Livestock Program, Focal point CIAT Humidropics CRP, Member, PPMC Livestock and Fish CRP

Role in Livestock CRP: Leads the Livestock Feeds and Forages Flagship

Name: Polly ERICKSEN

Current position and affiliation: Program leader, Livestock Systems and Environment, International Livestock Research Institute

Profile: Ericksen has over 18 years of experience working on agricultural development, natural resource management and global environmental change in developing countries. This includes experience working for the World Agroforestry Centre, Catholic Relief Services, a research fellowship at Columbia University's International Research Institute for Climate and Society (IRI), and five years at the University of Oxford working with the Global Environmental Change and Food Systems (GECAFS) initiative of the Earth Systems Science Partnership. She has served the ILRI focal point for the Dryland Systems and CCAFS programs.

Employment:

2010-2013, Principal Scientist, ILRI

2005-2010, Senior Researcher, Environmental Change Institute, University of Oxford,

Education:

1998, PhD in Soil Science, University of Wisconsin-Madison

1991, MSc in Economics, University of Wisconsin-Madison

Selected Recent Peer-reviewed publications:

- Robinson, L.W., Ericksen, P.J., Chesterman, S. and Worden, J. 2015. Sustainable intensification in drylands: What resilience and vulnerability can tell us. *Agricultural Systems* 135: 133-140.
- Ericksen, P., Leeuw, J. de, Thornton, P., Said, M., Notenbaert, A. and Herrero, M. 2013. Climate change in sub-Saharan Africa: What consequences for pastoralists? IN: Scoones, I., Catley, A. and Linds, J. 2013. Pastoralism and development in Africa: Dynamic Change at the Margins. London: Earthscan.
- Ericksen, P., Said, M., Leeuw, J. de, Silvestri, S. and Zaibet, L. 2012. Mapping ecosystem services in the Ewaso N'giro catchment of Kenya. *International Journal of Biodiversity, Ecosystem Services and Management*. <http://dx.doi.org/10.1080/21513732.2011.651487>.
- Thornton, P.K., Jones, P.G., Ericksen, P.J. and Challinor, A.J. 2011. Agriculture and food systems in sub-Saharan Africa in a four-plus degree world. *Philosophical Transactions of the Royal Society A* 369: 117-136
- Ingram, J.S.I., Ericksen, P.J. and Liverman, D.M. 2010. Food Security and Global Environmental Change. London: Earthscan.

Other Evidence of Leadership, large-program management and delivery: Leads ILRI's Livestock Systems and Environment Program, which includes over 40 staff in five countries with an annual budget of about USD 10 million. Serves as ILRI's focal point for CCAFS since 2012. Served as ILRI's focal point and regional coordinator ESA for Dryland Systems 2012 to 2015. For GECAFS she led cross regional teams in food systems research (S. Asia, S. Africa and the Caribbean).

Role in Livestock CRP: Leads the Livestock and the Environment Flagship

Name: Steven J. STAAL

Current position and affiliation: Program leader, Policy, Trade and Value Chains at the International Livestock Research Institute (ILRI).

Profile: Staal has over twenty years of experience in various aspects of smallholder agriculture in Africa and Asia, in research and research management. Following his PhD in agricultural economics from the University of Florida, he joined ILRI as an agricultural economist on the Market-Oriented Smallholder Dairy (MOSD) research team in Nairobi, Kenya. He subsequently played roles as dairy team leader, director of the Market Opportunities Program, and deputy director general. His research has addressed smallholder producer competitiveness, policies in input and output markets serving livestock keepers, economic efficiency and public health in informal dairy markets, consumer demand for dairy products, evaluation of technology interventions on smallholder farms, and spatial analysis of the intensification of smallholder livestock systems.

Employment:

2013-2016, Regional Representative for East and Southeast Asia, ILRI

2006-2013, Director, Market Opportunities Theme, ILRI

Education:

1995, PhD in Agricultural Economics, University of Florida

1989, MSc in Agricultural Economics, University of Florida

Selected Recent Peer-reviewed publications:

- Baltenweck, I. and Staal, S.J. 2007. Beyond one-size-fits-all: differentiating market access measures for commodity systems in the Kenyan highlands. *Journal of Agricultural Economics* 58: 536-548.
- Staal, S.J., Waithaka, M.M., Owour, G.A. and Herrero. M. 2004. Demand and supply changes in the livestock sector and their impact on smallholders: the case of dairy in Kenya. IN: Smith, O.E. et al. 2004. Responding to the Livestock Revolution – The role of globalisation and implications for poverty alleviation. BSAS Publication 33. Nottingham, UK: Nottingham University Press.
- S. J. Staal, I. Baltenweck, M. M. Waithaka, T. deWolff, L. Njoroge. 2002. Location and uptake: integrated household and GIS analysis of technology adoption and land use, with application to smallholder dairy farms in Kenya. *Agricultural Economics* 27: 295-315.
- Staal, S.J., Ehui, S. and Tanner, J. 2000. Livestock-Environment Interactions under Intensifying Production. IN: D. R. Lee and C. B. Barrett. 2000. Tradeoffs or Synergies? Agricultural Intensification, Economic Development and the Environment. Wallingford, UK: CAB International: 345-364.
- Staal, S.J., Delgado, C. and Nicholson, C. 1997. Smallholder Dairying under transaction costs in East Africa. *World Development* 25(5): 779-794.

Other Evidence of Leadership, large-program management and delivery: As Director of ILRI Markets Theme, supervised team of over 30 scientists based in SSA, Asia and Central America. This team was responsible for some of ILRI's largest and most consequential impact-oriented bilateral projects with development partners.

Role in Livestock CRP: Leads the Livestock Livelihoods and Agri-Food Systems Flagship

Management and Cross-Cutting themes (6)

Name: Iddo DROR

Current position and affiliation: Head of Capacity Development, ILRI

Profile: Dror has 15+ years' capacity development experience, gained in academia and international development, combined with experience in teaching, research, and fellowship administration. His career track has included assignments with UN agencies and the private sector, Universities and NGOs. In addition to leading ILRI's Capacity Development Unit, is the Chair of the Steering Committee of the CGIAR Capacity Development Community of Practice, and contributes to capacity development in several CRPs including Livestock and Fish, Humidtropics, A4NH, and Drylands Systems.

Employment:

2007-2012, Director of Operations/Member of Board of Directors, Micro Insurance Academy, India.

2002-2007, Program Director, International Organizations MBA, University of Geneva, Switzerland

Education:

2008, PhD in Economic and Social Sciences, University of Geneva, Switzerland

2003, MBA, University of Geneva, Switzerland

Selected Recent Peer-reviewed publications:

- Dror, I., Cadilhon, J.J., Schut, M., Misiko, M. and Maheshwari, S. 2016. Innovation platforms for agricultural development: Evaluating the mature innovation platforms landscape. UK: Routledge.
- Dror, I., Maheshwari, S. and Mude, A.G. 2015. Using satellite data to insure Livestock: IBLI and the development of the world's first insurance for African pastoralists. Nairobi, Kenya: ILRI.
- Panda P, Dror I, Koehlmoos T, Hossain S, John D, Khan J, Dror D. 2013. What factors affect take up of voluntary and community based health insurance programmes in low- and middle-income countries? A systematic review (Protocol). London: EPPI-Centre, Social Science Research Unit, Institute of Education, University of London
- Dror, Iddo H, Dalal, Aparna and Michal Matul. 2012. Emerging Practices in Consumer Education on Risk Management and Insurance, in Protecting the Poor - A Microinsurance Compendium – Volume II, Churchill C., Matul., M. (eds), ISBN 978-92-2-125744-8 International Labour Office, Chapter 14, pp. 286-299

Other Evidence of Leadership, large-program management and delivery: Dror leads the capacity development work for the current CRP Livestock and Fish and CRP Humidtropics. He was also instrumental in setting up a CGIAR Community of Practice on capacity development, is its current Chair, and leads CGIAR-wide efforts across the entire portfolio as part of this work.

Role in Livestock CRP: Leads the capacity development work

Name: Rhiannon PYBURN

Current position and affiliation: Senior Advisor, Sustainable Economic Development and Gender, Royal Tropical Institute (KIT)

Profile: Pyburn has over 20 years of experience in the social dynamics of agricultural research and development - specifically smallholder inclusion and gender dimensions of value chain development and agricultural innovation systems. She has worked throughout sub-Saharan Africa (Côte d'Ivoire, Ghana, Sierra Leone, The Gambia, Burkina Faso, Mali, Kenya, Rwanda, Uganda and Tanzania, in particular), South and South-East Asia and the Pacific. Since June 2104, Pyburn has lead the KIT team working with CRP Livestock and Fish to make gender integration into technical Flagship research more robust, as well as providing interim leadership to the Livestock and Fish Gender Initiative.

Employment:

2002-2008. Freelance Consultant – Sustainable Development.

2002. Academic Researcher. Communication and Innovation Studies, Wageningen University

1999. Program Officer. Canada World Youth, Vancouver.

1997-1999. Project Supervisor British-Colombia-Indonesia Program. Canada World Youth.

1995-1996. Project Leader - Penetanguishene, Ontario. Katimavik (a Canadian Youth Program).

Education:

2008. PhD research – Communication and Innovation Studies Group, Wageningen University.

2003. MSc Management of Agro-Ecological Knowledge and Social Change, Wageningen University

Selected Recent Peer-reviewed publications:

- Pyburn, R., Audet-Belanger, A., Dido, S., Quiroga, G and Flink I. 2015. Unleashing potential: gender and youth inclusive agri-food chains. KIT Working Paper series No. 2015-7.
- Laven, A. and Pyburn, R. 2015. Facilitating gender inclusive agri-business. *Knowledge Management for Development Journal* 11(1): 10- 30.
- Pyburn, R. and Woodhill J. 2014. Dynamics of Rural Innovation: a primer for emerging professionals. Amsterdam: LM Publishers.
- Sanyang, S., Pyburn, R., Mur, R. and Audet-Belanger, A. 2014. Against the Grain and to the Roots: maize and cassava innovation platforms in West and Central Africa. Amsterdam: KIT Publishers.
- KIT, APF, IIRR. 2012. Challenging Chains to Change: gender equity in agricultural value chain development. Amsterdam: KIT Publishers.
- Verhart, N. and Pyburn, R. 2012. Gender Equality in Certified Agricultural Value Chains. In: Harcourt, W. Women reclaiming sustainable livelihoods: spaces lost, spaces gained. New York: Palgrave : 62-82
- Verhart, N. and Pyburn, R. 2010. The Rough Road to Gender Equitable Growth: The case of Café de Mujer Guatemala. *Development* 53(3): 356–361.

Other Evidence of Leadership, large-program management and delivery: Global Standards Initiative. Lead a 4-year multi-organisation initiative exploring gender equity in certified coffee, tea, cocoa value chains.

Role in Livestock CRP: Leads the Gender Initiative

Name: Alessandra GALIE

Current position and affiliation: Social scientist-gender, International Livestock Research Institute (ILRI).

Profile: Galiè's research focuses on gender issues in the livestock value chain in Tanzania, Uganda, Vietnam and India in the framework of empowerment, agricultural research for development and food security. Before joining ILRI she worked at the International Centre for Agricultural Research in the Dry Areas (ICARDA) on gender research in empowerment, seed governance and participatory plant breeding.

Employment:

2012-2013, Gender Consultant, National Center for Agricultural Research and Extension of Jordan for FAO

2010-2012, Gender Consultant, ICARDA

2007-2010, Gender Research Fellow, ICARDA

2008, Gender Global Consultant, Transnational Institute

Education:

2013 PhD, Wageningen University

2003, MA in Anthropology of Development, University of London

Selected Recent Peer-reviewed publications:

- Galiè A. and P. Kantor 2016: 'From gender analysis to transforming gender norms: using empowerment pathways to enhance gender equity and food security in Tanzania', in Edited Collection: Transforming Gender and Food Security in the Global South. International Development Research Centre (IDRC) and Routledge.
- Galiè A., Mulema, A.A., Mora, A.M., Onzere, S. and Colverson, K. 2015. Exploring gender perceptions of resource ownership and their implications for food security among rural livestock owners in Tanzania, Ethiopia, and Nicaragua *Agriculture and Food Security* 4: 2
- Galiè A. 2014: 'Syrian women farmers: seeking gender balance in participatory plant breeding' in S. Brisolara, D. Seigart, S. Sengupta (eds.), *Feminist evaluation and research: theory and practice*, Guilford, New York: 284-310.
- Galiè A. 2013. Governance of seed and food security through participatory plant breeding: Empirical evidence and gender analysis from Syria. *Natural Resources Forum* 37: 31-42.
- Galiè A. 2013. Empowering women farmers: the case of participatory plant breeding in ten Syrian households. *Frontiers: a Journal of Women's Studies* 34: 58-92.
- Ceccarelli S., A. Galiè and S. Grando 2013: 'Participatory breeding for climate change related traits', in *Genomics & Breeding for Climate-Resilient Crops*, Chittaranjan K. (ed.), Springer-Heidelberg, Dordrecht, London, New York: 331-376.
- Galiè A., J. Jiggins and Struik, P. 2012: Women's identity as farmers: a case study from ten households in Syria. *NJAS: Wageningen Journal of Life Sciences* 64-65: 25-33.
- Galiè A. 2012: 'Equal access to seed and food security in Syria', in *Insights*, 82, Institute of Development Studies (IDS), University of Sussex, UK.

Other Evidence of Leadership, large-program management and delivery:

Leading gender research at ILRI for the CRP Livestock and Fish

Role CRP Livestock: Gender Initiative; Livestock Livelihoods and Agri-Food Systems Flagship, leads cluster 2.

Role in Livestock CRP: Gender scientist

Name: Anouka VAN EERDEWIJK

Current position and affiliation: Senior Advisor Gender Equality and Social Development, Royal Tropical Institute (KIT)

Profile: van Eerdewijk has over fifteen years of experience in the fields of gender equality, sustainable development and institutional transformation. She has worked in sub-Saharan Africa (Senegal, Ethiopia, Uganda, Zimbabwe, Ghana), Bangladesh and India. Her expertise includes gender mainstreaming and transformative change; gender relations in sustainable agriculture; gender training and feminist knowledge transfer, and; governance and norm diffusion processes. Anouka van Eerdewijk is a part of the KIT team supporting gender integration into technical research in the CRP Livestock and Fish and has also advised and conducted research for CRPs MAIZE and WHEAT on gender dimensions of their research programs.

Employment:

2012-2013, independent researcher and consultant.

2006-2012, Assistant professor, Centre for International Development Issues Nijmegen, Radboud University, Netherlands

Education:

2007, PhD in Social Sciences, Radboud University Nijmegen

1998, Masters degree in Development Studies, Radboud University Nijmegen

Selected Recent Peer-reviewed publications:

- van Eerdewijk, A. 2015. Gender mainstreaming: Views of a post-Beijing feminist. IN: Harcourt, W. 2015. Palgrave handbook on Gender and Development: Critical Engagements in feminist theory and practice.. New Yprk: Palgrave.
- Davids, T. and van Eerdewijk, A. 2015. The smothering of feminist knowledge: gender mainstreaming articulated through neoliberal governmentalities. IN: Bustelo, M., Ferguson, L. and Forest. M. 2-15. The Politics of Feminist Knowledge Transfer: Exploring Gender Training and Gender Mainstreaming. New York: Palgrave.
- van Eerdewijk, A. and Danielsen K. 2015. Gender Matters in Farm Power. Amsterdam: KIT, CIMMYT and CRP MAIZE.
- van der Vleuten, A., Eerdewijk A. van and Roggeband, C. 2014. Gender Equality Norms in Regional Governance: Transnational Dynamics in Europe, South America and Southern Africa. New York: Palgrave.
- van Eerdewijk, A. 2014. The Micro-politics of Evaporation: Gender Mainstreaming in Practice. *Journal of International Development* 26: 345-355.

Role in Livestock CRP: Gender Initiative.

Name: Michael KIDOIDO

Current position and affiliation: Scientist - Agricultural Economist, International Livestock Research Institute (ILRI).

Profile: For the last 4 years, Kidoido has supported the Livestock and Fish CRP monitoring, evaluation and learning team and ILRI's overall impact assessment work. His training and focus is in applying agricultural household models in solving resource use problems including assessing the technical and economic efficiency of resource use, technology uptake adoption and analyzing the welfare effects associated with agricultural technology use.

Employment:

2011-2007, Teaching Associate, Ohio State University.

2001-2006, Assistant Lecturer, Makerere University, Kampala, Uganda.

Education:

2011, PhD in agricultural economics, The Ohio State University, USA.

2001, MSc in agricultural Economics, Makerere University Kampala, Uganda.

Selected Recent Peer-reviewed publications:

- Kidoido, M. and Korir, L. 2015. Do low-income households in Tanzania derive income and nutrition benefits from dairy innovation and dairy production? *Food Security* 7(3): 681-692.
- Kidoido, M. and Child, K. 2014. Evaluating value chain interventions: A review of recent evidence. ILRI Discussion Paper 26. Nairobi: ILRI.
- Dehinenet, G., Mekonnen, H., Kidoido, M., Ashenafi, M., and Guerne Bleich, E. 2014. Factors influencing adoption of dairy technology on small holder dairy farmers in selected zones of Amhara and Oromia National Regional States, Ethiopia. *Discourse Journal of Agriculture and Food Sciences* 2(5): 126-135.
- Erbaugh, J.M., Donnermeyer, J., Amujal, M. and Kidoido, M. 2010. Assessing the impact of farmers' field schools (FFS) on IPM adoption in Uganda. *Journal of the Association of International Agricultural and Extension Education* 17:5-17.
- Esbern, F., Aben, C. and Kidoido, M. 2004. Smallholder agricultural technology development in Soroti district: Synergy between NAADS and farmer field schools (FFS) in Uganda. *Journal of Agricultural Sciences* 9(1): 250-257.

Role in Livestock CRP: Contribute to Monitoring, Evaluation and Learning and work on developing and validating theories of change

Name: Jane POOLE

Current position and affiliation: Head, Research Methods Group, International Livestock Research Institute (ILRI).

Profile: Poole's expertise is in planning, developing and implementing research methodology processes and providing support (statistics, data management and GIS) including cross-site learning and comparative analysis relevant to CRP activities; developing research protocols and other research processes, including contributing to the design of monitoring, learning and evaluation and impact assessment studies; support to research teams on the application of statistical methodologies for data analysis; and training (supporting and providing) for staff, students and partners in research methods, statistics, spatial analysis and data management.

Employment:

2003-2006, Statistician, Forest Research, UK

2000-2003, Statistician and Project Coordinator, CABI, Kenya

1997-2000, Biometrician, World Agroforestry Centre (ICRAF), Kenya.

Education:

1997, MSc in applied statistics, Reading University

1995, BSc in applied mathematics, University of London.

Selected Recent Peer-reviewed publications:

- Duncan, A., Vanlauwe, B., Poole, J., Notenbaert, A., Baltenweck, I. and Steeg, J. van de. 2014. Site selection guidance for Humidtropics—A CGIAR Research Program. <http://hdl.handle.net/10568/49609>
- Gassner, A., Alvare, L.M., Bamba, Z., Beare, D., Bernardo, M., Biradar, C., Brakel, M. van, Chapman, R., Dileepkumar, G., Dieng, I., Erlita, S., Fulss, R., Poole, J., Kshatriya, M., Reinhard Simon, G.S., Prasai, N., Garruccio, M., Staiger Rivas, S., Rajasekharan, M. and Chukka, S.R. 2013. White Paper: Shifting the goal post - from high impact journals to high impact data. Montpellier, France: CGIAR Consortium. <http://hdl.handle.net/10568/52063>
- Njuki, J., Poole, J., Johnson, N., Baltenweck, I., Pali, P., Lokman, Z. and Mburu, S. 2011. Gender, livestock and livelihood indicators. Nairobi, Kenya: ILRI. <http://hdl.handle.net/10568/33974>
- Staal, S., Poole, J., Baltenweck, I., Mwacharo, J., Notenbaert, A., Randolph, T., Thorpe, W., Nzuma, J. and Herrero, M. 2009. Targeting strategic investment in livestock development as a vehicle for rural livelihoods. Nairobi, Kenya: ILRI. <http://hdl.handle.net/10568/35206>
- Jorge, M.A.B., Lukuyu, B., Marita, C., Mwangi, D.M., Kinuthia, E., Baltenweck, I. and Poole, J. 2014. Assessing the uptake and disease impact of Napier grass in Kenya. ILRI Project Report. Nairobi, Kenya: ILRI. <http://hdl.handle.net/10568/51336>

Role in Livestock CRP: Research methods, open access and data management support to flagships; research quality, cross-site learning and comparative analysis, monitoring, evaluation and learning and impact assessment under CRP management function.

Name: Linda OPATI

Current position and affiliation: Intellectual Property & Legal Counsel, International Livestock Research Institute (ILRI).

Profile: Opati's specialisation is in IP and compliance management in research (laws, regulations, policies) and expertise in Legal management and support (contract drafting, negotiations, advisory, compliance and implementation) of complex multi-jurisdictional research contracts and legal transactions relevant to CRP activities; developing tools for the management, tracking and monitoring of IP outputs and IP transactions (patents and licensing, open access licensing, copyrights); support to research teams (planning, execution, tracking and compliance) with IP and legal compliance and regulations; training support for staff, students and partners in IP management for research.

Employment:

2008-2009, IP and Commercial law Associate, Kaplan & Stratton Advocates Nairobi Kenya

2006-2008, State Counsel Criminal Prosecutions, State Law Office Kenya

2005-2006, Legal and Policy Research Officer, International Centre for Insects - ICIPE, Kenya

Education:

2007 Post-graduate IP Law Specialisation (with distinction) University of South Africa, South Africa

2003 Bachelor of Laws LLB degree, Moi University, Kenya

Selected Recent Peer-reviewed publications:

- Wekesa M., Sihanya B., Opati L. et al 2009 – Chapter 2 *IP rights in Health, Impact on access to drugs on 2009* [Intellectual Property Rights in Kenya](#)

Role in Livestock CRP: Legal and IP.

Name: Peter BALLANTYNE

Current position and affiliation: Head, Communications and Knowledge Management, International Livestock Research Institute (ILRI)

Profile: Ballantyne has worked in agricultural information and knowledge for 25 years, championing open access, participatory communications, local content, social media and the use of information and communications technologies in development. He is an experienced facilitator and is involved in several ILRI and CRP projects, contributing especially to engagement and collaboration activities in the Livestock and Fish CRP. Before ILRI, he led communications and knowledge management activities in several research, NGO and policy institutes in the Netherlands.

Employment:

2006-2009, Director, Euforic, The Hague, the Netherlands

2003-2005, Deputy Director, INASP, UK

2001-2003, Team Leader, IICD, the Netherlands

1992-2000, Program Coordinator, ECDPM, the Netherlands

Education:

1983, MS, University of South Carolina, USA

1980, BA (Hons), Leeds Polytechnic, UK

Selected Recent Peer-reviewed publications:

- Hendrickx, S.C.J., Ballantyne, P.G., Duncan, A.J., Teufel, N. and Ravichandran, T. 2015. Scaling and innovation platforms. Innovation Platforms Practice Brief 13. Nairobi, Kenya: ILRI.
- Carlile L, Ballantyne P, Ensor J, Foerch W, Garside B, Harvey B, Patterson Z, Thornton P, Woodend J. 2013. Climate change and social learning (CCSL): supporting local decision making for climate change, agriculture and food security. CCSL Learning Brief No. 1. Copenhagen, Denmark: CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS).
- Rudgard, S., Ballantyne, P.G., Castello, R. Del, Edge, P., Hani, M., Maru, A., Morras, E., Nichterlein, K., Porcari, E. and Treinen, S. 2011. ICTs as enablers of agricultural innovation systems. IN: World Bank. 2011. ICT in Agriculture e-sourcebook. Washington D.C.: World Bank. 113-150.
- Ballantyne, P.G., Maru, A. and E.M. Porcari. 2010. Information and Communication Technologies— Opportunities to Mobilize Agricultural Science for Development. *Crop Science* 50(2): S1-S7.
- Ballantyne, P.G. 2009. Accessing, Sharing and Communicating Agricultural Information for Development: emerging trends and issues. *Information Development* 25(4): 260-271

Role in Livestock CRP: Lead work on communication and engagement and open access

Livestock Genetics Flagship – key scientists (10)

Name: Tadelles DESSIE

Current position and affiliation: Scientist animal breeding and genetics and ACGG project leader

Research Profile: Dessie is scientist at the International Livestock Research Institute (ILRI) where he leads the African Chicken Genetics Gains project. He has a BSc in animal Sciences from Alemaya University, an MSc in Sustainable Tropical Animal Production Systems from the Swedish University of Agriculture and a PhD in Animal Genetics and Breeding from Humboldt University of Berlin. His research is focused around improved utilization of animal genetic resources.

Employment:

2006-2013, Research Officer, International Livestock Research Institute

2004-2006, Project supervisor, International Livestock Research Institute

1997-1998, Head of the Department of Animal Sciences, Alemaya University of Agriculture (AUA)

Education:

2003, PhD in Animal Genetics and Breeding, Humboldt University of Berlin

1996, MSc in Sustainable Tropical Animal Production Systems, Swedish University of Agriculture

Selected Recent Peer-reviewed publications:

- Dessie, T., Gebreyesus, G., Mamo, Y., Dong-Hun Kim, Gyung-Rae Cho, Hyun-Jung Jung, Okeyo, A.M. and Sung-Jong Oh. 2014. Country based Domestic Animal Genetic Resource Information System (C-DAGRIS) for Selected African and Asian Countries. *Journal of Embryo Transfer* 29: 29-33.
- Edea, Z., Dadi, H., Kim, S.W., Park, J.H., Shin, G.H., Dessie, T. and Kim, K.S. 2014. Linkage disequilibrium and genomic scan to detect selective loci in cattle populations adapted to different ecological conditions in Ethiopia. *Journal of Animal Breeding and Genetics* 131(5): <http://dx.doi.org/10.1111/jbg.12083>
- Gizaw, S., Goshme, S., Getachew, T., Haile, A., Rischkowsky, B., van Arendonk, J.A., Valle-Zarate, A., Dessie, T. and Mwai, A.O. 2014. Feasibility of pedigree recording and genetic selection in village sheep flocks of smallholder farmers. *Tropical Animal Health and Production* 46: 809-814. <http://dx.doi.org/10.1007/s11250-014-0569-6>.
- Dessie, T., Taye, T., Dana, N., Ayalew, W. and Hanotte, O. 2011. Current state of knowledge on phenotypic characteristics of indigenous chickens in the tropics. *World's Poultry Science Journal* 67: 507-516.
- Dessie, T., Taye, T., Dana, N., Ayalew, W. and Hanotte, O. 2012. Current state of knowledge on indigenous chicken genetic resources of the tropics: domestication, distribution and documentation of information on the genetic resources. *World's Poultry Science Journal* 68: 11-20.

Scientific management and leadership: Dessie has more than 20 years of research and development experience in various national and international research and development organizations. Currently he is a Scientist and PI/Project leader of the African Chicken Genetic Gains (ACGG) project; and group leader for Biosciences Group based in ILRI-Ethiopia and officially representing Animal Biosciences in ILRI Ethiopia.

Role in Livestock CRP: Leads the African Chicken Genetic Gains program, Livestock Genetics Flagship

Name: Aynalem HAILE

Current position and affiliation: Senior Small Ruminant Scientist (genetics and breeding) at the International Center for Agricultural Research in the Dry Areas (ICARDA)

Profile: Haile has over 17 years of research and development experience in various national and international research and development organizations. Currently, he is a Senior Small Ruminant Scientist at ICARDA where he is involved in various projects dealing mainly with small ruminant breeding and genetics. Before joining ICARDA, Haile worked for ILRI in different capacities including coordination of a project on community-based sheep breeding programs in Ethiopia. His interests are improving livelihoods through improved animal production and sustainable use of animal genetic resources with special focus on often neglected community-based participatory approaches, addressing the vast majority of smallholders of the developing world. He has received short-term courses such as project management, outcome mapping, project design and proposal development, group facilitation skills, planning, monitoring and evaluation, animal breeding, capacity building for sustainable use of animal genetic resources in developing countries, and data analyses. He has authored or co-authored more than 155 publications in peer-reviewed Journals and edited proceedings.

Employment:

2011-2014, Small ruminant scientist, ICARDA

2007-2011, Research Officer, ILRI

2004-2007, Assistant Professor, Jimma University, Ethiopia

2000-2003, Head, Department of Animal Sciences, Jimma University, Ethiopia

Education:

2006, PhD in Animal Genetics and Breeding, National Dairy Research Institute, India

1999, MSc in Animal Production, Alemaya University, Ethiopia.

Selected Recent Peer-reviewed publications:

- Mueller, J.P., Rischkowsky, B., Haile, A., Philipsson, J., Mwai, A.O., Besbes, B., Valle Zárate, A., Tibbo, M., Mirkena, T., Duguma, G. and Sölkner, J., Wurzinger, M. 2015. Community based livestock breeding programs: essentials and examples. *Journal of Animal Breeding and Genetics* 132: 155–168. <http://dx.doi.org/10.1111/jbg.1213630>
- Gizaw, S., Goshme, S., Getachew, T., Haile, A., Rischkowsky, B., van Arendonk, J.A., Valle-Zárate, A., Dessie, T. and Mwai, A.O. 2014. Feasibility of pedigree recording and genetic selection in village sheep flocks of smallholder farmers. *Tropical Animal Health and Production* 46: 809-814. <http://dx.doi.org/10.1007/s11250-014-0569-6>.
- Gizaw, S., Rischkowsky, B., Valle-Zárate, A., Haile, A., van Arendonk, J.A.M., Mwai, A. O., Dessie, T. 2014. Breeding programs for smallholder sheep farming systems: I. Evaluation of alternative designs of breeding schemes. *Journal of Animal Breeding and Genetics* <http://dx.doi.org/10.1111/jbg.12101>
- Gizaw, S., van Arendonk, J.A., Valle-Zárate, A., Haile, A., Rischkowsky, B., Dessie, T., Mwai, A.O. 2014. Breeding programs for smallholder sheep farming systems: II. Optimization of cooperative village breeding schemes. *Journal of Animal Breeding and Genetics* <http://dx.doi.org/10.1111/jbg.12102>.
- Mirkena, T., Duguma, G., Willam, A., Wurzinger, M., Haile, A., Tibbo, M., Okeyo, A.M., Sölkner, J., 2012. Community-based alternative breeding plans for indigenous sheep breeds in four agro-ecological zones of Ethiopia. *Journal of Animal Breeding and Genetics* 129: 244–253.

Role in Livestock CRP: ICARDA focal person for the Livestock Genetics Flagship

Name: Jianlin HAN

Current position and affiliation: Principal Scientist, CAAS-ILRI Joint Laboratory on Livestock and Forage Genetic Resources, China

Profile: Han works on molecular characterization of animal genetic resources using population genetic and genomic approaches. Prior to joining ILRI, he undertook cytogenetic, biochemical and molecular genetic studies as well as breeding research in indigenous Chinese livestock (camel, yak, cattle, sheep, goat, pig, horse, donkey and chicken). He set up the International Yak Information Centre in 1994, now hosted at GAU, and he is the editor of the International Yak Newsletter. He was the main organizer of the International Congresses on Yak held in Lanzhou (1994), Xining (1997), Lhasa (2000) and Chengdu (2004). His research interests are animal husbandry in extreme ecological environments of the high Hindu Kush Himalayan region and the central Asian steppes (yak) as well as in the low central Asian deserts (Bactrian camel). At ILRI, he works on the genetic and genomic characterization and improvement of indigenous animal genetic resources in Asia and Africa.

Employment:

1984 – 2000, Teaching Assistant, Associate Professor and Professor, Gansu Agricultural University, Gansu, China

Education:

2000, PhD in Ecology, Lanzhou University, China

1984, Bachelors in Animal Science, Gansu Agricultural University, China

Selected Recent Peer-reviewed publications:

- Gorkhali, N.A., Jiang, L., Shrestha, B.S., He, X.H., Zhao, Q.J., Han, J.L. and Ma, Y.H. 2015. High occurrence of mitochondrial heteroplasmy in Nepalese indigenous sheep (*Ovis aries*) compared to Chinese sheep. *Mitochondrial DNA* <http://dx.doi.org/10.3109/19401736.2015.1041134>
- Caixia Gao, Lingxia Han, Jianlin Han, Jiasen Liu, Qian Jiang, Dongchun Guo and Liandong Qu. 2015. Establishment of six homozygous MHC-B haplotype populations associated with susceptibility to Marek's disease in Chinese specific pathogen-free BWEL chickens. *Infection, Genetics and Evolution* 29: 15-25.
- P. Ajmone-Marsan, L. Colli, J.L. Han, A. Achilli, H. Lancioni, S. Joost, P. Crepaldi, F. Pilla, A. Stella, P. Taberlet, P. Boettcher, R. Negrini, J.A. Lenstra, Italian Goat, Econogene Consortia and Globaldiv Consortia (2014). The characterization of goat genetic diversity: Towards a genomic approach. *Small Ruminant Research* 121: 58-74. <http://dx.doi.org/10.1016/j.smallrumres.2014.06.010>.
- David Wragg, Joram M Mwacharo, José A Alcalde, Chen Wang, Jian-Lin Han, Jaime Gongora, David Gourichon, Michèle Tixier-Boichard and Olivier Hanotte (2013). Endogenous retrovirus EAV-HP linked to blue egg phenotype in Mapuche fowl. *PLOS ONE* 8: e71393.

Scientific management and leadership: His research group at the CAAS-ILRI Joint Laboratory on Livestock and Forage Genetic Resources, Institute of Animal Science, Chinese Academy of Agricultural Sciences (CAAS), Beijing, China currently includes several Ph.D. and Master students and visiting scientists from Bangladesh, Vietnam, Sri Lanka, Pakistan and Iran. Funding is mainly provided by Chinese Government contribution to CAAS-ILRI Joint Laboratory on Livestock and Forage Genetic Resources in Beijing.

Role in Livestock CRP: Livestock Genetics Flagship focal point for Asia, in particular, leading the genetic and genomics characterization work of Asian livestock.

Name: Stephen KEMP

Current position and affiliation: Program Leader, Animal Biosciences, International Livestock Research Institute (ILRI) and Professor of tropical livestock genetics and health at the Roslin Institute, University of Edinburgh

Profile: Kemp led a series of important research programs, which established novel approaches for investigating the genomics of tropical adaptation, notably disease resistance. He leads a group concerned with genetics, genomics and conservation of livestock diversity and has established a unique structure – physical, human and informatics – to support this work. He has expertise in the genomics of tropical adaptation, particularly host-pathogen interactions and mechanisms of tolerance and resistance as well as informatics systems. He leads ILRI's cross-cutting *LiveGene* initiative.

Employment:

2005-2012, Senior Scientist and Genomics Team Leader, International Livestock Research Institute

2000-2014, Professor of Molecular Genetics, University of Liverpool

1995-2000, Lecturer, University of Liverpool

1991-1995, Project Leader, Ruminant Genetics, International Laboratory for Research on Animal Diseases

Education:

1985, PhD, Immunogenetics, University of Edinburgh

1979, BSc (Hons) Zoology, University of Wales

Selected Recent Peer-reviewed publications:

- Noyes, H., Githiori, J., Bradley, J., Kemp, S., and Behnke, M. 2014. Evidence for genes controlling resistance to *Heligmosomoides bakeri* on mouse chromosome 1. *Parasitology* 7: 1-10.
- Roex N., Noyes, H., Brass, A., Bradley, D., Kemp, S., and Kay S. 2014. Novel SNP Discovery in African Buffalo, *Syncerus caffer*, using High-Throughput Sequencing. *PLOS ONE* 7: 11
- Norling, M., Kihara, A. and Kemp S.J., 2013. Web-Based Biobank System Infrastructure Monitoring Using Python, Perl, and PHP *Biopreservation and Biobanking*. 11: 355-358.
- Silva, M.V.B., Sonstegard, T.S., Hanotte, O., Mugambi, J.M., Garcia, J.F., Nagda, S., Gibson, J.P., Iraqi, F.A., McClintock, A.E., Kemp, S.J., Boettcher, P.J., Malek, M., Tassell, C.P. Van, Baker, R.L. 2012. Identification of quantitative trait loci affecting resistance to gastrointestinal parasites in a double backcross population of Red Maasai and Dorper sheep. *Animal Genetics* 43:63-71.
- Noyes, H., Brass, A., Obara, I., Anderson, S., Archibald, A.L., Bradley, D.G., Fisher, P., Freeman, A., Gibson, J., Gicheru, M., Hall, L., Hanotte, O., Hulme, H., McKeever, D., Murray, C., Oh, S.J., Tate, C., Smith, K., Tapio, M., Wambugu, J., Williams, D.J., Agaba, M., and Kemp, S.J. 2011. Genetic and expression analysis of cattle identifies candidate genes in pathways responding to *Trypanosoma congolense* infection. *PNAS* 108: 9304-9.
- Hanotte, O., Dessie, T. and Kemp S.J. 2010. Time to Tap Africa's Livestock Genomes. *Science* 328:1640-1641.

Scientific management and leadership: His research group at ILRI comprises some 35 scientists, post-docs, students and technicians. He created and manages the LiveGene initiative. He played a key role in the establishment of the Joint Centre for Tropical Livestock Genetics and Health. Total funding for the group is approximately \$5m/year. Current and recent major funders include DFID, BMGF, BBSRC, Wellcome Trust, National Science Foundation.

Role in Livestock CRP: Coordinate the genomics livestock activities of the Livestock Genetics Flagship.

Name: Hans KOMEN

Current position and affiliation: Professor, Animal Breeding and Genomics Centre, Wageningen UR

Profile: Komen works on the design and implementation of tailor-made, small-scale breeding programs. He is involved in several projects, mainly related to small ruminants, poultry and fish. His research interest is in matching breeding goals with farming systems, and understanding biological adaptation of breeds and species to environments as a source of new traits for selection. A third area of research focusses on the design of low cost breeding programs that combine genomic information with mating strategies to maintain genetic variation.

Employment:

- 2007 – 2016, Associate professor, Animal Breeding and Genomics Group, Wageningen University
- 2004 – 2007, Assistant professor, Animal Breeding and Genetics Group, Wageningen University

Selected Recent Peer-reviewed publications:

- S. Gizaw, J. Komen, J.J. Windig, O. Hanotte, J. A. M. Van Arendonk. 2007. Conservation priorities for Ethiopian sheep breeds combining threat status, contributions to genetic diversity and to farmer livelihoods. *Genetics, Evolution and Selection* 40: 433-447.
- S. Gizaw, J.A.M. van Arendonk, J. Komen. 2007. Selection on linear size traits to improve live weight in Menz sheep under nucleus and village breeding programs. *Livestock Science*, 118(1/2): 92-98.
- Robbert J.W. Blonk, Hans Komen, Andries Kamstra, and Johan van Arendonk. 2010. Estimating Breeding Values With Molecular Relatedness and Reconstructed Pedigrees in Natural Mating Populations of Common Sole, *Solea solea*. *Genetics* 184 (1): 213-219.
- P. Sae-Lim, H. Komen, A. Kause, J. A. M. van Arendonk, A. J. Barfoot, K. E. Martin, J. E. Parsons. 2012. Defining desired genetic gains for rainbow trout breeding objective using analytic hierarchy process. *Journal of Animal Sciences* 90(6): 1766-1776.
- Kariuki C.M., H. Komen, A.K. Kahi, J.A.M. van Arendonk. 2014. Optimizing the design of small-sized nucleus breeding programs for dairy cattle with minimal performance recording. *Journal of Dairy Science* **97**: 7963-7974.

Scientific management and leadership: Hans is Team Leader of the Breeding Programs and Genetic Diversity group of the Animal breeding and Genomics Centre in Wageningen UR. The center combines expertise in quantitative and numerical genetics, genomics and breeding program design. He also leads the aquaculture research group of Wageningen Livestock research. He is member of the executive board and chairman of the education committee of EU funded European graduate school EGSABG – consortium of 4 universities that have developed a joint PhD degree program. He is also program leader for training of early stage researchers and responsible for formulation of long term breeding program for the African chicken genetic gains program.

Role in the Livestock CRP: He will provide scientific inputs and be involved in capacity building activities across flagship activities within the scope of cluster 2 (Improved breeds of livestock) and 3 (Continuous genetic gains, multiplication and delivery systems).

Name: Dirk Jan de KONING

Current position and affiliation: Professor in Animal Breeding, Swedish University of Agricultural Sciences.

Profile: de Koning's research focuses on linking DNA variation to functional variation in livestock and beyond. He is interested in experimental design as well as data analysis and bioinformatics. His research has moved from QTL and GWAS to include functional studies like gene expression as well as applications in genomic selection. His research covers the main livestock species in particular poultry, dairy cattle and pigs. A current Swedish research project ([Mistra Biotech](#)) is on the development of novel tools for molecular breeding in livestock and crops. Another focus is genetic dissection and selection of bone strength in laying hens in collaboration with Lohmann Tierzucht and The Roslin Institute in Edinburgh. His group collaborates on RNA sequencing in chickens with Leif Andersson in Uppsala and the group of Paul Siegel at Virginia Polytech. Aquaculture is an emerging area of interest where our group recently became responsible for breeding programs in arctic char and rainbow trout in Sweden. Prof. de Koning is Deputy EIC for [G3 Genes, Genomes, Genetics](#), and editor for Genetics.

Employment:

2007 – 2010, Roslin Institute, Band 4 Group Leader

2003 – 2007, Roslin Institute, Career Track Appointment

Education:

1996, MSc in Animal Sciences, Wageningen University

2001, PhD in Life Sciences, Wageningen University

Selected Recent Peer-reviewed publications:

- Esinam N Amuzu-Aweh, Henk Bovenhuis, **Dirk-Jan de Koning**, Piter Bijma, 2015. Predicting heterosis for egg production traits in crossbred offspring of individual White Leghorn sires using genome-wide SNP data. *Genetics Selection Evolution* 47 (1), 27
- A Marubayashi Hidalgo, JWM Bastiaansen, M Soares Lopes, R Veroneze, MAM Groenen, D-J de Koning. 2015. Accuracy of genomic prediction using deregressed breeding values estimated from purebred and crossbred offspring phenotypes in pigs. *Journal of Animal Science* 93 (7), 3313-3321
- Nadaf, J., Berri, C., Dunn, I., Godet, E., Bihan-Duval, E. Le and Koning, D.J. de. 2014. An Expression QTL of Closely Linked Candidate Genes Affects pH of Meat in Chickens. *Genetics* 196: 867-874. <http://dx.doi.org/10.1534/genetics.113.160440>
- Strucken, E.M., Bortfeldt, R.H., Koning, D.J. de and Brockmann, G.A. 2012. Genome-wide associations for investigating time-dependent genetic effects for milk production traits in dairy cattle. *Animal Genetics* 43: 375–382.
- Calus, M.P.L., Koning, D.J. de and Haley, C.S. 2010. Including copy number variation in association studies to predict genotypic values. *Genetics Research* 92: 115-125.
- Zhang, Z., Liu, J.F., Ding, X.D., Bijma, P., Koning, D.J. de and Zhang, Q. 2010. Best Linear Unbiased Prediction of Genomic Breeding Values Using a Trait-Specific Marker-Derived Relationship Matrix. *PLOS ONE* 5: e12648.
- Wei, W.H., Knott, S., Haley, C.S. and Koning, D.J. de. 2010 Controlling false positives in the mapping of epistatic QTL. *Heredity* 104: 401-409.

Scientific management and leadership: de Koning is head of the Section of Quantitative Genetics at the Department of Animal breeding and Genetics. He is also the deputy Head of Department and a member of several faculty committees. He has been workpackage leader in two large EC projects (EADGENE and SABRE). In the Swedish Mistra Biotech project (totalling 80 Million SEK over 8 years) he leads the activities on developing tools for molecular breeding with a total budget of 18 Million SEK). His other research funding is from EC (ERA-NET, Marie Curie), Formas (Sweden), and SLF (Sweden). DJ de Koning is a regular scientific panel member for BBSRC, UK (iCASE, TRDF, BBR, Aquaculture) and grant referee for BBSRC, ANR (France), NWO (NL), and ERC. He is current Deputy EIC for G3 and editor for

Genetics. He recently completed his term on the editorial board of *Heredity* and as an executive member of the Genetics Society, UK.

Role in Livestock CRP: de Koning will be the main link between ILRI and the Department of Animal Breeding and Genetics at SLU. He will contribute to projects related to genome analysis, genomic selection and animal breeding.

Name: Karen MARSHALL

Current position and affiliation: Senior Scientist at the International Livestock Research Institute

Profile: Karen has close to 10 years' experience with the CGIAR, working on issues related to animal genetic resource use in developing countries, from upstream applications such as characterizing the genomics of disease resistance, to applied applications such as comparing different livestock breed-types in terms of benefit to their women and men keepers. Her work has covered a range of species (cattle, sheep, goat, pigs, camel), production systems (from intensifying to pastoral / agro-pastoral), and geographical locations (both within sub-Saharan Africa and Asia).

Employment:

2002-2006, Senior Lecturer in Genetics, School of Rural Science and Agriculture, University of New England, Australia

Selected Recent Peer-reviewed publications:

- Idea, N., Van Bui, Q., Nguyen, N.T., Lapar, M. L., Marshall, K. 2015. Characterisation of smallholder pig breeding practices within a rural commune of North Central Vietnam. *Tropical Animal Health and Production* [http://dx.doi.org/ 10.1007/s11250-015-0817-4](http://dx.doi.org/10.1007/s11250-015-0817-4)
- Benavides, M.V., Sonstegard, T.S., Kemp, S., Mugambi, J.M., Gibson, J.P., Baker, R.L., Hanotte, O., Marshall, K., Van Tassell, C. 2015. Identification of Novel Loci Associated with Gastrointestinal Parasite Resistance in a Red Maasai x Dorper Backcross Population. *PLOS ONE* 10: e0122797. <http://dx.doi.org/10.1371/journal.pone.0122797>
- Marshall, K. 2014. Optimizing the use of breed types in developing country livestock production systems: a neglected research area. *Journal of Animal Breeding and Genetics* 131:329-340
- Marshall, K., Mtimet, N., Wanyoike, F., Ndiwa, N. 2014. The Complex and Gender Differentiated Objectives of Livestock Keeping for Somali Pastoralists. *Proceedings of the 10th World Congress on Genetics Applied to Livestock Production*, American Society of Animal Science e-communication.

Scientific management and leadership: Karen is currently the Flagship leader of the Livestock and Fish CRP Genetics Flagship, principal investigator or lead animal breeder / geneticists on various projects aimed at improving the livelihoods of livestock keepers in developing countries, and co-lead of the Dairy Genomics program of the Centre for Tropical Livestock Genetics and Health.

Role in Livestock CRP: Lead work on pig animal breeding and genetics; co-lead the Dairy Genomics program of the Centre for Tropical Livestock Genetics and Health.

Name: Raphael MRODE

Current position and affiliation: Principal scientist in quantitative dairy cattle genetics at the International Livestock Research Institute (ILRI) and professor in Quantitative Animal genetics and genomics at the Scottish Rural College (SRUC).

Profile: Mrode has undertaken outstanding research in the application of linear models for data analyses, methods to reduce the dimensions of multi-trait analyses and genetic evaluation of new or novel traits at the national and international level. Recent work has been focused on the incorporation of molecular information in genetic evaluation procedures for traits of economic importance in

livestock. This encompasses the use SNPs in computation of genomic breeding values and genomic selection on a within and across breeds basis. He is the author of a widely used text book on the use of linear models and genomic selection on the prediction of the genetic merit of animals.

Employment:

1991 – 2004, Senior Geneticist in MDC Evaluations Limited, United Kingdom.

1989 – 1991, Post-doctoral Fellow in the Department of Animal and Poultry science, University of Guelph

1988 – 1989, Post-doctoral Fellow in AFRC Institute of Animal Physiology and Genetic Research, Edinburgh

1984 – 1985, Assistant Lecturer, University of Ife, Nigeria

1982 – 1984, Graduate Assistant, University of Ife, Nigeria

Education

1988, PhD, University of Edinburgh, UK

1984, MPhil, University of Ife, Nigeria

1981, B.Agric, University of Ife, Nigeria

Selected Recent Peer-reviewed publications:

- Mucha, S., Mrode, R., I. MacLaren-Lee, M. Coffey, J. Conington. 2015. Estimation of genomic breeding values for milk yield in the UK dairy goats. *Journal of Dairy Science*
- Pickering, N., Chagunda, M., Banos, G., Mrode, R., and McEwan, J., Walls, E. 2015. Genetic parameters for predicted methane production and laser methane detector measurements. *Journal of Animal Science* 93:11-20
- Mucha, S., Mrode, R., Coffey, M., and Conington, J. 2014. Estimation of genetic parameters for milk yield across lactations in mixed breed dairy goats. *Journal of Dairy Science* 99: 2455-2461
- Mrode R.A. 2014. Linear models for the prediction of animal breeding values. Wallingford: CAB International.
- Abdollahpour, R., Shahrabak, M. M., Nejati-Javaremi, A., Torshizi, R.V and **Mrode, R** (2013) Genetic analysis of milk yield, fat and protein content in Holstein dairy cows in Iran: Legendre polynomials random regression model applied. *Archiv Tierzucht (Archives Animal Breeding)* 56:48

Scientific management and leadership:

He is technical in charge of the national (UK) genetic evaluation activities of Edinburgh Genetic Evaluation Services (EGENES) at the Scotland Rural College (SRUC) supervising two other geneticist and several computer programmers. Currently he is supervising and co-supervising 3 PhD students at the University of Edinburgh and in addition to working with several post-doctoral fellows in SRUC. Also he is the line manager for one geneticist at the Animal Biosciences, ILRI, Kenya and a member of the technical committee of the international body in charge of dairy genetic evaluation (INTERBULL). Active and on-going research collaborations include the University of Edinburgh and China Agricultural University

Role in Livestock CRP: Dairy quantitative and genomics methods including the application of novel methods for data capture and the genomic profiling of young bulls

Name: Joram MWACHARO

Current position and affiliation: Scientist, Small Ruminant Genetics and Genomics, International Center for Agricultural Research in Dry Areas (ICARDA)

Profile: Mwacharo is scientist at ICARDA where he leads research activities on small ruminant genetics and genomics. His research aims to understand patterns of genetic variation and the extent to which they reveal the evolutionary history and levels of genetic diversity (neutral and functional) in livestock

populations. He is also interested in understanding the phylogeographic and genetic structure of host-parasite-pathogen interphases and how they relate to the epidemiology of infectious diseases in wild and domestic animals. His research currently uses next generation genomics tools to dissect the genetic architecture of complex and simple Mendelian inherited traits, detect genome-wide signatures of artificial and natural selection and novel candidate genes to provide insights on the evolutionary mechanisms of adaptation and genetic basis of production traits.

Employment

2009-2013, Senior Research Fellow, University of Nottingham

2009-2009, Research Consultant, Food and Agriculture Organization

2008-2008, Short-term Post-doc/Consultant International Livestock Research Institute

Education

2008, PhD in Animal Genetics and Breeding (Molecular and Population Genetics), Tokyo University of Agriculture

2000, MSc in Animal Genetics and Breeding, University of Nairobi

Selected Recent Peer-reviewed Publications

- Kim E-S, Elbeltagy AR, Aboul-Naga AM, Rischkowsky B, Sayre B, Mwacharo JM, Rothschild MF. 2016. Multiple genomic signatures of selection in goats and sheep indigenous to a hot arid environment. *Heredity* 116, 255-264.
- Kanduma EG, Mwacharo JM, Mwaura S, Njuguna JN, Nzuki I, Kinyanjui PW, Githaka N, Heyne H, Hanotte O, Skilton RA, Bishop RP. 2016. Multi-locus genotyping reveals absence of genetic structure in field populations of the brown ear tick (*Rhipicephalus appendiculatus*) in Kenya. *Ticks and Tick-Borne Diseases* 7, 26–35.
- Wragg D, Mason AS, Yu L, Kuo R, Lawal RA, Desta TT, Mwacharo JM, Cho C-Y, Kemp S, Burt DW, Hanotte O. 2015. Genome-wide analysis reveals the extent of EAV-HP integration in domestic chicken. *BMC Genomics* 16, 784.
- Salim, B., Taha, K.M., Hanotte, O. and Mwacharo, J.M. 2014. Historical demographic profiles and genetic variation of the East African Butana and Kenana indigenous dairy zebu cattle. *Animal Genetics* 45:782-790.
- Mwacharo, J.M., Nomura, K., Hanada, H., Jianlin, H., Amano, T. and Hanotte, O. 2013. Reconstructing the origin and dispersal patterns of village chickens across East Africa: Insights from autosomal markers. *Molecular Ecology* 22: 2683-2697.

Leadership, management and delivery

- 2000-2004 Kenya Agricultural Research Institute: Principal Investigator, Genetic and phenotypic characterization of Zebu cattle from the Southeast rangelands of Kenya
- 2008-2008 Food and Agriculture Organization. Lead Investigator, Analysing threats to global animal genetic resources

Role in Livestock CRP: Livestock Genetics Flagship, cluster 1

Name: Ally Okeyo MWAI

Current position and affiliation: Principal Scientist at the International Livestock Research Institute (ILRI) and Senior Lecturer in Quantitative Genetics and Animal Breeding at the University of Nairobi, Kenya

Profile: Okeyo is currently leading the Platform for Dairy Genetic Gains Research for development Project at ILRI and has led and participated in several research aimed at interrogating the genetic diversity of indigenous African livestock genetic diversity and in identifying what livestock breed types or genetics are best suited for the various production systems in developing countries, and how best such animals can be multiplied and delivered to farmers to enable the latter extract full benefits from

keeping such animals. Okeyo has also led several research activities and projects aimed at human capacity building in developing countries in order for such countries to sustainably utilize the existing animal genetic resources, focusing in sub-Saharan Africa, South and South East Asia.

Employment:

2008-2013, Senior Scientist and Team Leader, Livestock Breeding Strategies Research, ILRI

2004-2013, Scientist and Project leader: ILRI-BOKU-Austria Projects on Delivery of genetic change under low input systems in Developing countries

1989-, Lecturer and Senior Lecturer, Animal Genetics and Breeding, Department of Animal Production, University of Nairobi (leave of absence from 2004)

1980-1988, In-charge, goat Breeding Research Facility and Flock, National Animal Husbandry Research center, Kenya

Education:

2000, PhD in Animal Breeding and Genetics, University of Nairobi.

1984, Masters in Animal Science, University of California-Davis.

Selected Recent Peer-reviewed publications:

- Okeyo, A. M., Hanotte, O., Young-Jun Kwon and Seoae Cho. 2015. African Indigenous Cattle: Unique Genetic Resources in a Rapidly Changing World. *Journal of Animal Science* 28: 911-921. <http://dx.doi.org/10.5713/ajas.15.0002R>
- Getachew, T., Gizaw, S., Wurzinger, M., Haile, A., Rischkowsky, B., Okeyo, A.M. Sölkner, J. and Mészáros, G. 2015. Survival analysis of genetic and non-genetic factors influencing ewe longevity and lamb survival of Ethiopian sheep breeds. *Livestock Science* 176: 22-32. <http://dx.doi.org/10.1016/j.livsci.2015.03.021>
- Mueller, J.P., Rischkowsky, B., Haile, A., Philipsson, J., Okeyo, A.M. Besbes, B., Valle Zárate, A., Tibbo, M., Mirkena, T., Duguma, G., Sölkner, J. and Wurzinger, M. 2015. Community based livestock breeding programs: Essentials and examples *Journal of Animal Breeding and Genetics*: 132: 155-168.
- Ojango, J.M.K., Marete, A., Mujibi, D., Rao, J., Poole, J., Rege, J.E.O., Gondro, C., Weerasinghe, W.M.S.P., Gibson, J.P. and Okeyo, A.M. 2014. A novel use of high density SNP assays to optimize choice of different crossbred dairy cattle genotypes in small-holder systems in East Africa, 10th World Congress on Genetics Applied to Livestock Production.
- Gizaw, S., Rischkowsky, B., Valle-Zárate, A., Haile, A., Arendonk, J.A.M. van., Okeyo, A.M. and Dessie, T. 2014. Breeding programs for smallholder sheep farming systems: I. Evaluation of alternative designs of breeding schemes. *Journal of Animal Breeding and Genetics* 131(5):341–349. <http://dx.doi.org/10.1111/jbg.12101>.

Scientific management and leadership: Managed and coordinated research group at ILRI, leading collaboration with NARS partners, international institutes and universities, and hosting international PhD and MSc students and visiting scientists. Funding has continuously been competitively obtained in the areas of livestock breeding strategies, attracting substantial funding from the Gates Foundation, ADA-Austria, USAID, among many others.

Role in Livestock CRP: Provide scientific support and leadership to ruminant breeding projects; he is leading the African Dairy Genetic Gain project.

Name: Julie OJANGO

Current position and affiliation: Scientist, Animal Breeding Strategies, International Livestock Research Institute

Research Profile: Ojango has 15 years of experience providing leadership in projects designed to identify appropriate breeds and breed combinations for ruminant livestock production systems found in developing countries. She has excellent skills in livestock data management and quantitative analyses, and has a good understanding of gender sensitivities in issues related to livestock production. She is involved in developing and testing livestock performance recording and feedback systems, piloting of breeding strategies in both extensive and small-holder systems, and in supporting institutional arrangements to deliver the desired outputs for the respective livestock sectors. She has good leadership and strong knowledge sharing skills and strives to impart information to transform the livestock sector and develop a next generation of scientists in developing countries.

Employment:

2010-2013, Research Officer, International Livestock Research Institute

2006-2011, Project Leader ILRI-SLU Capacity building for Sustainable Use of Animal Genetic Resources in Developing Countries

1995-2005, Lecturer in Animal Science, Egerton University, Kenya

Education:

2000, PhD in Animal Genetics and Breeding, Wye College, University of London

1990, MSc in Animal Production, University of Nairobi

Selected Recent Peer-reviewed publications:

- König, E.Z., Mirkena, T., Strandberg, E., Audho, J., Ojango, J., Malmfors, B., Okeyo, A.M, and Philipsson, J. 2016. Participatory definition of breeding objectives for sheep breeds under pastoral systems—the case of Red Maasai and Dorper sheep in Kenya. *Tropical Animal Health and Production*. 48(1): 9-20.
- Ojango, J.M.K., Audho, J., Oyieng, E., Recha, J., Muigai, A. 2015. Sustainable small ruminant breeding program for climate- smart villages in Kenya: Baseline household survey report. CCAFS Working Paper 127. Copenhagen, Denmark: CGIAR Research Program on Climate Change, Agriculture and Food Security.
- Zonabend, E., Okeyo, A.M., Ojango, J.M.K., Hoffmann, I., Moyo, S. and Philipsson, J. 2013. Infrastructure for sustainable use of animal genetic resources in southern and eastern Africa. *Animal Genetic Resources* 53:79-93
- Mulindwa, H., Galukande, E., Wurzinger, M., Ojango, J., Okeyo, A.M., Sölkner, J. 2011. Stochastic simulation model of Ankole pastoral production system: Model development and evaluation. *Ecological Modelling* 222(20-22): 3692-3700
- Kosgey, I.S.; Mbuku, S.M.; Okeyo, A.M.; Amimo, J.; Philipsson, J.; and J.M. Ojango. 2011. Institutional and organizational frameworks for dairy and beef cattle recording in Kenya: a review and opportunities for improvement. *Animal Genetic Resources* (48): 1-11

Scientific management and leadership: Julie is involved in leading projects implementing technical interventions for livestock improvement in Eastern Africa and Nicaragua. She also supervises work carried out by research technicians and post-doc scientists in the animal breeding and genetics team, in addition to graduate student projects for MSc and PhD students in both national and international universities.

Role in Livestock CRP: Contribute to the Livestock Genetics Flagship

Livestock Health Flagship – key scientists (10)

Name: Renée BAGE

Current position and affiliation: Senior lecturer (50%), Swedish University of Agricultural Sciences (SLU) and national reproduction expert (50%), Växa Sverige R&D (Development and Services for farmers).

Profile: Involved in research on cow reproduction and reproductive biotechnologies, in teaching, and in continuing education for veterinarians and artificial insemination/embryo transfer technicians. Currently scientific advisor for 8 postgraduate student projects in ruminant reproduction and udder health.

Employment:

2010-2014 Senior lecturer, Swedish University of Agricultural Sciences

2007-2010 Junior researcher, Swedish University of Agricultural Sciences

2003-2007 Assistant Professor, Swedish University of Agricultural Sciences

Education:

2011, Associate professor, Animal reproduction, Swedish University of Agricultural Sciences, Sweden.

2004, European Diplomat, Animal reproduction, sub-speciality ruminant reproduction and herd health.

Selected Recent Peer-reviewed publications:

- Abrahamsén, M., Persson, Y., Kanyima, B. and Båge, R. 2014. Prevalence of subclinical mastitis in dairy farms in urban and peri-urban areas of Kampala, Uganda. *Tropical Animal Health Production* 46(1): 99-105.
- Björk, S., Båge, R., Kanyima, B.M., André, S., Nassuna-Musoke, M.G., Owiny, D.O. and Persson, Y. 2014. Characterization of coagulase negative staphylococci from cases of subclinical mastitis in dairy cattle in Kampala, Uganda. *Irish Veterinary Journal* 67(1): 12.
- Kanyima, B., Båge, R., Owiny, D., Ntallaris, T., Lindahl, J., Magnusson, U. and Nassuna-Musoke, M. 2014. Husbandry factors and the resumption of luteal activity in open and zero-grazed dairy cows in urban and peri-urban Kampala, Uganda. *Reproduction in Domestic Animals* 49(4): 673-8.
- Båge, R., Kanyima, B.M. and Wredle, E. 2014. Dairy in peri-urban farming for food security and income. IN: Magnusson, U. and Bergman, K.F. 2014. *Urban and peri-urban agriculture for food security in low-income countries – Challenges and knowledge gaps*. SLU-Global Report 2014:4. Uppsala: Swedish University of Agricultural Sciences: 60-63.
- Benon, K.M., Owiny, D.O., Båge, R., Nassuna-Musoke, M.G., Humblot, P. and Magnusson, U. 2015. Managerial practices and factors influencing reproductive performance of dairy cows in urban/peri-urban areas of Kampala and Gulu, Uganda. *Acta Veterinaria Scandinavica* 57: 35.

Other Evidence of Leadership, large-program management and delivery: 2011-2013 Coordinator of the Faculty's Research school "Translational and Comparative Medicine, Swedish University of Agricultural Sciences, Sweden; 2006-2011 Coordinator during of the Swedish-Baltic farm animal reproduction network.

Role in Livestock CRP: Ruminant reproduction and herd health expert in Livestock Health Flagship.

Name: Michel DIONE

Current position and affiliation: Scientist-Animal Health, International Livestock Research Institute

Profile: My expertise is in identifying animal health constraints and opportunities through field surveys, participatory methods and biological sampling, field testing interventions for livestock diseases to improve animal health; and developing and testing gender sensitive models of delivery of animal health services, including community-based health care in different livestock and farming systems.

Employment:

- 2012-2015, Post-Doctoral Fellow-Animal Health, International Livestock Research Institute, Kampala, Uganda
- 2010-2012, Post-Doctoral Fellow-Molecular Microbiologist and Laboratory Manager, UK Medical Research Council Unit, The Gambia
- 2006-2010, Research Associate-Veterinary Epidemiologist, International Trypanotolerance Centre, The Gambia

Education:

2010, PhD in Medical Sciences, University of Antwerp, Belgium

2006, MSc in Environmental Sciences, University Cheikh Anta Diop, Dakar, Senegal

Selected Recent Peer-reviewed publications:

- Kungu, J.M., Dione, M.M., Ejobi, F., Harrison, L.J.S., Poole, E.J., Pezo, D. and Grace, D. 2016. Sero-prevalence of *Taenia Solium* cysticercosis in rural and urban smallholder pig production settings in Uganda. *Acta Tropica*
- Nantima, N., Davies, J., Dione, M., Ocaido, M., Okoth, E., Mugisha, A. and Bishop, R. 2016. Enhancing knowledge and awareness of biosecurity practices for control of African swine fever among smallholder pig farmers in four districts along the Kenya–Uganda border. *Tropical Animal Health and Production*
- Kungu, J.M., Dione, M.M., Ocaido, M. and Ejobi, F. 2015. Status of *Taenia solium* cysticercosis and predisposing factors in developing countries involved in pig farming. *International Journal of One Health* 1: 6-13.
- Chenais, E., Boqvist, S., Sternberg-Lewerin, S., Emanuelson, U., Ouma, E., Dione, M., Aliro, T., Masembe, C. and Ståhl, K. 2015. Knowledge, attitudes and practices related to African swine fever within smallholder pig production in northern Uganda. *Transboundary and Emerging Diseases*
- Dione, M.M., Akol, J., Roesel, K., Kungu, J., Ouma, E.A., Wieland, B. and Pezo, D. 2015. Risk factors for African swine fever in smallholder pig production systems in Uganda. *Transboundary and Emerging Diseases*
- Dione, M.M., Ouma, E.A., Roesel, K., Kungu, J., Lule, P. and Pezo, D. 2014. Participatory assessment of animal health and husbandry practices in smallholder pig production systems in three high poverty districts of Uganda. *Preventive Veterinary Medicine* 117: 565-576.
- Dione, M.M., Ikumapayi, U.N., Saha, D., Mohammed, N.I., Geerts, S., Ieven, M., Adegbola, R.A., and Antonio, M. 2011. Clonal differences between Non-Typhoidal Salmonella (NTS) recovered from children and animals living in close contact in The Gambia. *PLoS Neglected Tropical Diseases* 5 (5): e1148

Other Evidence of Leadership, large-program management and delivery: I have led the value chain assessment of animal health constraints and opportunities in the pig value chain in Uganda; identified and begun pilot testing of animal health related interventions for upgrading the smallholder pig value chain, established a database on prevalence and risk factor for a range of pig diseases that affect production and are of public health, established a bio-bank of pig specimens, disseminated research outputs and delivered capacity building to smallholder livestock value chain actors.

Role in Livestock CRP: Lead Livestock Health work package in the smallholder pig value chain in Uganda

Name: Naftaly GITHAKA

Current position and affiliation: Tick Unit Support Manager, International Livestock Research Institute (ILRI)

Profile: Githaka has worked for more than 8 years on ticks and tick-borne diseases.

Employment:

2014-2015, Tick Unit Support Officer, International Livestock Research Institute, Kenya

2009-2013, Graduate teaching assistant/Doctoral student, Hokkaido University, Japan

2002-2009, Research Assistant, International Livestock Research Institute, Kenya

Education:

2013: PhD in Veterinary Medicine, Hokkaido University, Japan

2008: MSc in Zoology (Vector Biology and Parasitology), Jomo Kenyatta University of Agriculture and Technology, Kenya

Selected Recent Peer-reviewed publications:

- Julian Rothen, Naftaly Githaka, Esther G. Kanduma, Cassandra Olds, Valentin Pflueger, Stephen Mwaura, Richard P. Bishop, and Claudia Daubenberger. 2016. Matrix-Assisted Laser Desorption/Ionization Time of Flight Mass Spectrometry for comprehensive Indexing of East African Ixodid Tick Species. *Parasites and Vectors*
- Kanduma, EG, Mwacharo JM, Mwaura S, Njuguna JN, Nzuki I, Kinyanjui PW, Githaka N, Heyne H, Hanotte O, Skilton RA, Bishop RP. 2016. Multi-locus genotyping reveals absence of genetic structure in field populations of the brown ear tick (*Rhipicephalus appendiculatus*) in Kenya. *Ticks and Tick Borne Diseases* 7(1):26-35.
- Gomes H, Moraes J, Githaka N, Martins R, Isezaki M, Vaz Ida S Jr, Logullo C, Konnai S, Ohashi K. 2015. Vaccination with cyclin-dependent kinase tick antigen confers protection against Ixodes infestation. *Veterinary Parasitology* 211(3-4):266-73.
- Githaka N, Konnai S, Bishop R, Odongo D, Lekolool I, Kariuki E, Gakuya F, Kamau L, Isezaki M, Murata S, Ohashi K. 2014. Identification and sequence characterization of novel *Theileria* genotypes from the waterbuck (*Kobus defassa*) in a *Theileria parva*-endemic area in Kenya. *Veterinary Parasitology* 202(3-4): 180-93.
- Githaka N, Konnai S, Skilton R, Kariuki E, Kanduma E, Murata S, Ohashi K; 2013; Genotypic variations in field isolates of *Theileria* species infecting giraffes (*Giraffa camelopardalis tippelskirchi* and *Giraffa camelopardalis reticulata*) in Kenya. *Parasitol Int.* 62(5): 448-53.
- Parizi LF, Githaka NW, Logullo C, Konnai S, Masuda A, Ohashi K, da Silva Vaz I Jr. 2012. The quest for a universal vaccine against ticks: cross-immunity insights. *Vet J.* 194(2):158-65.
- Githaka N, Konnai S, Kariuki E, Kanduma E, Murata S, Ohashi K. 2012. Molecular detection and characterization of potentially new *Babesia* and *Theileria* species/variants in wild felids from Kenya. *Acta Trop.* 124(1):71-8.

Other Evidence of Leadership, large-program management and delivery: PI, Wellcome Trust Public Engagement with Science Grant; Lead, ILRI-Brazilian Universities project on anti-tick vaccines and acaricide resistance surveillance; Development of 3-year research strategy for ILRI tick unit.

Role in Livestock CRP: Contribute to Livestock Health Flagship

Name: Magdalena JACOBSON

Current position and affiliation: Professor in Porcine Medicine, Department of Clinical Science, Swedish University of Agricultural Sciences (SLU)

Profile: Porcine Health Management, Diplomate ECPHM (European College of Porcine Health Management). Research area: Infectious diseases in pig.

Employment:

2012-2014, Senior Lecturer with extension duties (appointed), Department of Clinical Science, Swedish University of Agricultural Sciences

2011-2012, Senior Lecturer in Porcine Medicine (promoted), Department of Clinical Science, Swedish University of Agricultural Sciences

2008-2011, Researcher in Porcine Medicine (promoted), Department of Clinical Science, Swedish University of Agricultural Sciences

Education:

2003, PhD in Veterinary Medicine, Swedish University of Agricultural Sciences, Sweden

Selected Recent Peer-reviewed publications:

- Ikwap, K., Erume, J., Owiny, D., Nasinyama, G., Melin, L., Bengtsson, B., Lundeheim, N., Fellström, C., Jacobson, M. 2014. *Salmonella* species in piglets and weaners from Uganda: Prevalence, antimicrobial resistance and herd level risk factors. *Preventive Veterinary Medicine* 115:1-2, 39-47. doi: 10.1016/j.prevetmed.2014.03.009.
- Larsson, J., Aspan, A., Grandon, R., Lindberg, R., Westergren, E., Jacobson, M. 2014. Neonatal piglet diarrhoea associated with enteroadherent *Enterococcus hirae*. *J. Comp. Pathol.* 151, 137-147, <http://dx.doi.org/10.1016/j.jcpa.2014.04.003>.
- Sannö, A., Aspan, A., Hestvik, G., Jacobson, M. 2014. Presence of *Salmonella* spp., *Yersinia* (Y.) *enterocolitica*, *Y. pseudotuberculosis* and *Escherichia coli* O157:H7 in wild boars. *Epidemiol. Infect.* 142:12, 2542-2547, doi: 10.1017/S0950268814000119.
- Blomström, A.-L., Ley, C., Jacobson, M. 2014. Astrovirus as a possible cause of congenital tremor type All in piglets? *Acta Vet. Scand.* 56:82; doi: 10.1186/s13028-014-0082-y, <http://www.actavetscand.com/content/56/1/82>.
- Sternberg Lewerin, S., Persson-Waller, K., Alenius, S., Elvander, M., Fellström, C., Tråvén, M., Wallgren, P., Österberg, J., Jacobson, M. 2015. Risk assessment as a tool for improving external biosecurity at farm level. *BMC Vet. Res.* 11:117, doi: 10.1186/s12917-015-0477-7
- Larsson, J., Aspán, A., Lindberg, R., Grandon, R., Båverud, V., Fall, N., Jacobson, M. 2015. Pathological and bacteriological characterisation of neonatal porcine diarrhoea with uncertain aetiology. *J. Med. Microbiol.* 64:8, 916-926. doi:10.1099/jmm.0.000108

Other Evidence of Leadership, large-program management and delivery:

Supervisor for nine master students and six PhD students; Member of the scientific board for three research foundations; External grants achieved from several research foundations, amounting to in total € 1.000.000; Co-supervisor within the Makerere University SIDA-Sarec Research Program 2012-2014 "Capacity building in Livestock Biotechnology, Production & Ecosystem Health towards Improving Livelihoods in Uganda's Cattle Corridor and Northern region (ILUCCaN); Member of the credential committee in "the European Committee on Porcine Health Management"; Member of the international expert committee for the evaluation of the research at DTU vet (Denmark Technical University), Denmark, 2015; Member of the international review panel for the H.C. Ørsted Postdoc Programme, co-funded by Marie Curie Actions, 2016.

Role in Livestock CRP: Livestock Health Flagship: Support and expertise in research on herd health and herd health management in pig production within developing countries.

Name: Joerg JORES

Current position and affiliation: Principal Scientist, vaccine biosciences, International Livestock research Institute (ILRI)

Profile: Jores expertise is in microbiology with a focus on mycoplasma, Development of diagnostic assays (ELISA, lateral flow assays), Development of Mycoplasma vaccines, ruminant immunology, genomics, synthetic biology, set up of large animal trials. In recent years, he has developed a novel cocktail ELISA for CBPP, worked with the private sector to produce a prototype field-applicable lateral flow test for CBPP, and developed a field-applicable recombinase polymerase amplification assay for CCPP.

Employment:

1999-2005, Scientific staff member, Free University Berlin, Faculty of Veterinary Sciences, Institute of Microbiology and Epizootics

1996-1999, Scientific staff member, Robert Koch-Institute, Berlin, Department of Horizontal Gene Transfer

Education:

2015, Venia docendi in the field bacteriology at the Vetsuisse Faculty/University of Bern, Switzerland

2006, Specialist degree, Microbiology ("Fachtierarzt für Mikrobiologie") Berlin, Germany

2001, PhD. in Veterinary Medicine, Free University of Berlin, Germany

Selected Recent Peer-reviewed publications:

- Schieck, E., Lartigue, C., Frey, J., Voza, N., Hegemann, J., Miller, R.A., Valguarnera, E., Muriuki, C., Meens, J., Nene, V., Naessens, J., Weber, J., Lowary, T.L., Vashee, S., Feldman, M.F. and Jores, J. 2016. Galactofuranose in Mycoplasma mycoides is important for membrane integrity and conceals adhesins but does not contribute to serum resistance. *Molecular Microbiology* 99(1): 55-70
- Fischer, A., Santana-Cruz, I., Schieck, E., Gourel, H., Lambert, M., Nadendla, S., Wesonga, H., Miller, R.A., Hegerman, J., Meens, J., Vashee, S., Frey, J. and Jores, J. 2015. High quality draft genomes of the *Mycoplasma mycoides* subsp. *mycoides* challenge strains Afadé and B237. *Genomic Sciences*.
- Liljander, A., Yu, M., O'Brien, E., Heller, M., Nepper, J.F., Weibel, D.B., Gluecks, I., Younan, M., Frey, J., Falquet, L. and Jores, J. 2015. A field-applicable recombinase polymerase amplification assay for rapid detection of *Mycoplasma capricolum* subsp. *capripneumoniae*. *Journal of Clinical Microbiology* <http://dx.doi.org/10.1128/JCM.00623-15>,
- Ssematimba, A., Jores, J. and Mariner, J.C. 2015. Mathematical modelling of the transmission dynamics of contagious bovine pleuropneumonia reveals minimal target profiles for improved vaccines and diagnostic assays. *PLOS ONE* 10(2): e0116730,
- Falquet, L., Liljander, A., Schieck, E., Gluecks, I., Frey, J. and Jores, J. 2014. Complete genome sequences of two virulent *Mycoplasma capricolum* subsp. *capripneumoniae* strains F38 and ILRI181. *Genome Announcements* 2: e01041-14.
- Corman, V.M., Jores, J., Meyer, B., Younan, M., Liljander, A., Said, M.Y., Gluecks, I., Lattwein, E., Bosch, B.-J., Drexler, J.F., Bornstein, S., Drosten, C. and Müller, M.A. 2014. MERS Coronavirus antibody levels in dromedary camels from Kenya, 1992 – 2013. *Emerging Infectious Diseases* 20(8): 1319-1322.

Other Evidence of Leadership, large-program management and delivery: Supervision of a research team consisting of 4 scientists, three technicians and two PhD students; Resource mobilization of several Million US\$

Role in Livestock CRP: Contribute to Livestock Health Flagship

Name: Henry KIARA

Current position and affiliation: Scientist, Animal Science for Sustainable Productivity, International Livestock Research Institute (ILRI)

Profile: Kiara has experience in veterinary epidemiology, participatory research methods, the delivery of animal health services, and working with pastoral and smallholder livestock production systems in East, Southern and West Africa. His recent work included: identifying animal health constraints to productivity in smallholder dairy value chain in Tanzania and Ethiopia, in-depth studies to identify the role of reproductive diseases in smallholder dairy in Tanzania, interventions to control East Coast fever, researching multi-pathogen disease burdens in Kenya and assessing the delivery of CBPP vaccine in a pastoral systems.

Employment:

1998-2014, Research Officer, ILRI Biosciences, Nairobi

1989-1998, Research Officer, Kenya Agricultural Research Institute, Nairobi, Kenya

1982-1989, Veterinary Investigation Officer, Ministry of Livestock Development, Kenya

Education:

1994, PhD in Applied Entomology, Rivers State University Science and Technology, Nigeria

1986, MSc in Tropical Veterinary Science, University of Edinburgh, UK

Selected Recent Peer-reviewed publications:

- Woolhouse, M.E.J., Thumbi, S.M., Jennings, A., Chase-Topping, M., Callaby, R., Kiara, H., Oosthuizen, M.C., Mbole-Kariuki, M.N., Conradie, I., Handel, I.G., Poole, E.J., Njiiri, E., Collins, N.E., Murray, G., Tapio, M., Auguet, O.T., Weir, W., Morrison, W.I., Kruuk, L.E.B., Bronsvoort, B.M. de C., Hanotte, O., Coetzer, J.A.W. and Toye, P.G. 2015. Coinfections determine patterns of mortality in populations exposed to parasite infection. *Science Advances* 1:e1400026.
- Kiara, H., Jennings, A., Bronsvoort, B.M. de C., Handel, I.G., Mwangi, S.T., Mbole-Kariuki, M., Wyk, I.C. van, Poole, E.J., Hanotte, O., Coetzer, J.A.W., Woolhouse, M.E.J. and Toye, P.G. 2014. A longitudinal assessment of the serological response to *Theileria parva* and other tick-borne parasites from birth to one year in a cohort of indigenous calves in western Kenya. *Parasitology* 141(10):1289-1298.
- Kairu-Wanyoike, S.W., Kiara, H., Heffernan, C., Kaitibie, S., Gitau, G.K., McKeever, D. and Taylor, N.M. 2014. Control of Contagious Bovine Pleuropneumonia: Knowledge, attitudes, perceptions and practices in Narok District of Kenya. *Preventive Veterinary Medicine* 115(3-4):143-156.
- Mbole-Kariuki, M.N., Sonstegard, T., Orth, A., Thumbi, S.M., Bronsvoort, B. M. de C., Kiara, H., Toye, P., Conradie, I., Jennings, A., Coetzer, K., Woolhouse, M.E.J. , Hanotte, O. and Tapio, M. 2014. Genome-wide analysis reveals the ancient and recent admixture history of East African Shorthorn Zebu from Western Kenya. *Heredity* 113: 297-305.
- Thumbi, S.M., Bronsvoort, B.M., Poole, E.J., Kiara, H., Toye, P., Ndila, M., Conradie, I., Jennings, A., Handel, I.G., Coetzer, J.A., Hanotte, O. and Woolhouse, M.E. 2013. Parasite co-infections show synergistic and antagonistic interactions on growth performance of East African zebu cattle under one year. *Parasitology* 4: 1-10.
- Thumbi, S.M., Bronsvoort, M.B.M., Kiara, H., Toye, P.G., Poole, J., Ndila, M., Conradie, I., Jennings, A., Handel, I.G., Coetzer, J.A.W., Steyl, J., Hanotte, O. and Woolhouse, M.E.J. 2013. Mortality in East African shorthorn zebu cattle under one year: Predictors of infectious-disease mortality. *BMC Veterinary Research* 9:175

Other Evidence of Leadership, large-program management and delivery: Co-PI and project coordinator for several large projects including a project to assess a modified CBPP vaccine in pastoral system in Kenya and the infectious disease of East Africa livestock. Currently leading an ECF Vaccine up-scaling project in Tanzania

Role in Livestock CRP: Livestock Health Flagship - contributing to the Tanzania dairy value chain.

Name: Vish NENE

Current position and affiliation: Program Director, Vaccine Biosciences, International Livestock Research Institute (ILRI) and Adjunct Faculty, Department of Veterinary Microbiology and Pathology, Washington State University.

Profile: Nene has over 30 years of experience in the area of vaccine related research. These revolve around a broad range of research interests that converge on developing improved or novel methods of infectious disease control, and in the use of whole genome sequence data and genomics technologies to underpin laboratory research, primarily in the field of veterinary vaccines.

Employment:

2007-2009, Associate Director, Institute for Genome Sciences, and Professor, Department of Microbiology and Immunology, University of Maryland School of Medicine, Maryland, USA.

2001-2007, Investigator, The Institute for Genomic Research (TIGR), Rockville, Maryland, USA.

1986-2001, Scientist, ILRI, Nairobi, Kenya.

Education:

1981, PhD, Department of Biochemistry, Queen's Medical Centre, University of Nottingham, UK.

1977, BSc (Hons.), Department of Physiology and Biochemistry, University of Southampton, UK.

Selected Recent Peer-reviewed publications:

- Warimwe, G.M., Gesharisha, J., Carr, B.V., Otieno, S., Otingah, K., Wright, D., Charleston, B., Okoth, E., Elena, L.-G., Lorenzo, G., Ayman, E.B., Alharbi, N.K., Al-dubaib, M.A., Brun, A., Gilbert, S.C., Nene, V. and Hill, A.V.S. 2016. Chimpanzee Adenovirus vaccine provides multispecies protection against rift valley fever. *Scientific Reports* 6:20117.
- Schieck, E., Lartigue, C., Frey, J., Vozza, N., Miller, R.A., Muriuki, C., Naessens, J., Nene, V., Lowary, T.L., Vashee, S., Feldman, M.F., Jores, J. 2015. Galactofuranose in *Mycoplasma mycoides* is important for membrane integrity, conceals adhesins but does not contribute to serum resistance. *Molecular Microbiology*
- Svitek, N., Nzau, B., Steinaa, L. and Nene, V. 2015. A method to discriminate between closely related bovine major histocompatibility complex class I alleles by combining established PCR-SSP assays with RFLPs. *Tissue Antigens* 85(4): 278-282.
- Heekin, A.M., Guerrero, F.D., Bendele, K.G., Saldivar, L., Scoles, G.A., Dowd, S.E., Gondro, C., Nene, V., Djikeng, A. and Brayton, K.A. 2013. Gut transcriptome of replete adult female cattle ticks, *Rhipicephalus (Boophilus) microplus*, feeding upon a *Babesia bovis*-infected bovine host. *Parasitology Research* 112(9):3075-3090.
- Nene, V., Svitek, N., Toye, P., Golde, W.T., Barlow, J., Buus, S. and Nielsen, M. 2012. Designing bovine T cell vaccines via reverse immunology. *Ticks and Tick-borne Diseases* 3(3):188-192.

Other Evidence of Leadership, large-program management and delivery: Principal Investigator for Bill and Melinda Gates Foundation (OPP1078791). "Improved vaccines for the control of East Coast fever in cattle in Africa." 2013-2017. Budget: \$11,999,826. Co-PI. USDA 58-5348-2-117F. "Collaboration to Advance Vaccine Control of East Coast fever (*Theileria parva*).". 2012-2017. Budget: \$3,000,000. Co-PI. National Science Foundation (0965346). "BREAD: A modern approach toward developing vaccines for critical bovine diseases impacting farmers in sub-Saharan Africa." 2010-2015. Budget: \$1,980,782.

Role in Livestock CRP: Livestock Health Flagship leads Cluster 3.

Name: Lucilla STEINAA

Current position and affiliation: Senior Scientist, immunology, International Livestock research Institute (ILRI)

Profile: Steinaa has expertise in cell-mediated and antibody-based immune mechanisms. She is a co-PI on the East Coast fever consortium project at ILRI and has started extending her research to include African swine fever and prior to ILRI worked on various human disease (viral and cancers) as Senior Scientist and project manager in the Biotech sector in Denmark. She has worked on various diseases including infectious diseases, vaccine development and relevant technologies for more than 20 years.

Employment:

2004-2009, Senior Scientist, Symphogen A/S, Denmark

1995-2003, Project manager / senior scientist/ research scientist, Pharmexa A/S, Denmark

1992-1993, Research Scientist, Department of Infectious Diseases, Hvidovre Hospital, Denmark.

Education:

2001, PhD in Cellular Immunology, University of Copenhagen, Denmark

1992, MSc in Cellular Immunology, University of Copenhagen, Denmark

Selected Recent Peer-reviewed publications:

- Nene, V., Kiara, H., Lacasta, A., Pelle, R., Svitek, N., and Steinaa, L. 2016. The biology of *Theileria parva* and control of East Coast fever - Current status and future trends. *Ticks and Tick-Borne Diseases*. <http://dx.doi.org/10.1016/j.ttbdis.2016.02.001>
- Svitek, N, Taracha, EL, Saya, R, Awino, E, Nene, V, and Steinaa, L. 2016. Analysis of the cellular immune responses to vaccines. IN: Brun, A. 2016. Vaccine Technologies for Veterinary Viral Diseases: Methods and Protocols. Dordrecht: Springer: 247-62. http://dx.doi.org/10.1007/978-1-4939-3008-1_16
- Svitek, N., Awino, E., Nene, V. and Steinaa, L. 2015. BoLA-6*01301 and BoLA-6*01302, two allelic variants of the A18 haplotype, present the same epitope from the Tp1 antigen of *Theileria parva*. *Veterinary Immunology and Immunopathology*.
- Svitek, N., Nzau, B., Steinaa, L. and Nene, V. 2015. A method to discriminate between closely related bovine major histocompatibility complex class I alleles by combining established PCR-SSP assays with RFLPs. *Tissue Antigens* 85(4): 278-282.
- Steinaa, L., Saya, R., Awino, E. and Tøye, P. 2012. Cytotoxic T lymphocytes from cattle immunized against *Theileria parva* exhibit pronounced cross-reactivity among different strain-specific epitopes of the Tp1 antigen. *Veterinary Immunology and Immunopathology* 145(3-4): 571-581.
- Koefoed, K., Steinaa, L., Soderberg, J.N., Kjaer, I., Jacobsen, H.J., Meijer, P.-J., Haurum, J.S., Jensen, A., Kragh, M., Andersen, P.S. and Pedersen, M.W. 2011. Rational identification of an optimal antibody mixture for targeting the epidermal growth factor receptor. *mAbs* 3(6): 584-595.

Evidence of leadership, management and delivery: First author and co-author of at least 8 patent families, for which products are now in clinical phase II trials for human disease; Co-PI in the current ECF consortium: Improved vaccine for the control of East Coast fever in cattle in Africa (Total amount: USD 11,799,524; Leading several parts of the research at ILRI).

Role in Livestock CRP: Through the Livestock Health Flagship, Contributing to the dairy value chain through the Vaccine Biosciences Platform and gradually also to the Pig Value chain in Uganda

Name: Nicholas SVITEK

Current position and affiliation: Scientist, immunology, International Livestock research Institute (ILRI)

Profile: Svitek has expertise in pathogenesis and reverse genetics of morbilliviruses. He has developed methods for high throughput sequencing of bovine MHC class I genes, optimizing peptide-MHC class I tetramers for assaying T cell responses and use of viral vectored vaccines.

Employment:

2011-2014, Postdoctoral fellow, International Livestock Research Institute

2010-2011, Research fellow in virology, Duke University /National University of Singapore

Education:

2010, PhD in Virology and Immunology, University of Quebec, Canada

2004, MSc in Microbiology and Immunology, University of Montreal, Canada

Selected Recent Peer-reviewed publications:

- Nene, V., Kiara, H., Lacasta, A., Pelle, R., Svitek, N., and Steinaa, L. 2016. The biology of Theileria parva and control of East Coast fever - Current status and future trends. *Ticks and Tick-Borne Diseases*. <http://dx.doi.org/10.1016/j.ttbdis.2016.02.001>
- Svitek, N, Taracha, EL, Saya, R, Awino, E, Nene, V, and Steinaa, L. 2016. Analysis of the cellular immune responses to vaccines. IN: Brun, A. 2016. Vaccine Technologies for Veterinary Viral Diseases: Methods and Protocols. Dordrecht: Springer: 247-62.
- Svitek, N., Awino, E., Nene, V. and Steinaa, L. 2015. BoLA-6*01301 and BoLA-6*01302, two allelic variants of the A18 haplotype, present the same epitope from the Tp1 antigen of Theileria parva. *Veterinary Immunology and Immunopathology*
- Svitek, N., Nzau, B., Steinaa, L. and Nene, V. 2015. A method to discriminate between closely related bovine major histocompatibility complex class I alleles by combining established PCR-SSP assays with RFLPs. *Tissue Antigens* 85(4): 278-282.
- Nene, V., Svitek, N., Toye, P., Golde, W.T., Barlow, J., Buus, S. and Nielsen, M. 2012. Designing bovine T cell vaccines via reverse immunology. *Ticks and Tick-borne Diseases* 3(3): 188-192.
- Hansen A.M., Rasmussen M., Svitek N., Golde W.T., Barlow J., Nene V., Buus S., Nielsen M. **2014**. Characterization of binding specificities of Bovine Leucocytes class I molecules: Impacts for rational epitope discovery. *Immunogenetics* 66(12):705-18
- Svitek, N., Hansen, A.M., Steinaa, L., Saya, R., Awino, E., Nielsen, M., Buus, S. and Nene, V. 2014. Use of “one-pot, mix-and-read” peptide-MHC class I tetramers and predictive algorithms to improve detection of cytotoxic T lymphocyte responses in cattle. *Veterinary Research* 45:50.

Other Evidence of Leadership, large-program management and delivery: 2010: Team leader-Rural development/international cooperation program with Quebec Without Borders-Mali, West Africa
2011-2014: Development of bovine peptide-MHC class I tetramers for utilization in the field of bovine immunology research.

Role in Livestock CRP: Immunologist, Developing next-generation vaccines against East Coast fever as part of Livestock Health Flagship.

Name: Barbara WIELAND

Current position and affiliation: Team Leader, herd health, International Livestock Research Institute (ILRI)

Profile: Wieland has broad experience in veterinary epidemiology research and in teaching at undergraduate and postgraduate level. Has worked on a variety of infectious diseases in different settings in Europe, African and Asia: African swine fever, Campylobacter, Brucellosis, Foot-and-Mouth disease, avian influenza, post-weaning multi-systemic wasting syndrome in pigs, porcine respiratory and reproductive syndrome, and other pig production diseases, and contagious pleuropneumonia in

cattle. Other research interests include motivation of farmers to control disease in their herds, improve productivity in herds, and application of risk assessment and disease modelling techniques to identify the best possible control options for farmers and to inform policy.

Employment:

2012-2015, Program manager animal health, Swiss Agency for Development and Cooperation

2006-2012, Lecturer in veterinary epidemiology, Royal Veterinary College, London/UK

Education:

2014, Certificate in Managing Rural Development, School of Oriental and African Studies, University of London

2009, Postgraduate Certificate in Academic Practice, King's College London

2005, PhD in Veterinary epidemiology, Vetsuisse faculty, University of Bern, Switzerland

Selected Recent Peer-reviewed publications:

- Asmare, K., Abebe, R., Sheferaw, D., Krontveit, R.I. and Wieland, B. 2016. Mange-mite infestation in small ruminants in Ethiopia: Systematic review and meta-analysis. *Veterinary Parasitology*
- Dione, M.M., Akol, J., Roesel, K., Kungu, J., Ouma, E.A., Wieland, B. and Pezo, D. 2015. Risk factors for African swine fever in smallholder pig production systems in Uganda. *Transboundary and Emerging Diseases*
- Wieland, B., Batsukh, B., Enktuvshin, S., Odontsetseg, N. and Schuppers, M. 2015. Foot and mouth disease risk assessment in Mongolia-Local expertise to support national policy. *Preventive Veterinary Medicine* 120(1): 115-23.
- Glanville, W.A. de., [Vial, L.](#), [Costard, S.](#), Wieland, B., Pfeiffer, D.U. 2014. Spatial multi-criteria decision analysis to predict suitability for African swine fever endemicity in Africa. [BMC Veterinary Research](#) 10(9).
- Onono, J., Wieland, B. and Rushton, J. 2014. Estimation of impact of contagious bovine pleuropneumonia on pastoralists in Kenya. *Preventive Veterinary Medicine* 115(3-4): 122–129.
- Alarcon, P., Dewberry, C. and Wieland, B. 2013. Pig farmers' perceptions, attitudes, influences and management of information in the decision-making process for disease control. *Preventive Veterinary Medicine* 16(3): 223-42.
- Onono, J., Wieland, B. and Rushton, J. 2013. Factors influencing choice of veterinary service provider by pastoralists in Kenya. *Tropical Animal Health and Production* 45(6): 1439-45.
- Costard, S., Wieland, B., Glanville, W. de, Jori, F., Rowlands, R., Vosloo, W., Roger, F., Dixon, L. and Pfeiffer, D. 2009. African swine fever: How can global spread be prevented? *Philosophical Transactions of the Royal Society B* 364: 2683-2696.

Other Evidence of Leadership, large-program management and delivery: Leads the herd health team at ILRI, managed the animal health program for SDC in Mongolia, at RVC acted as course director in the MSc Control of Infectious Diseases and as strand leader professional studies in the undergraduate curriculum and managed various research projects

Role in Livestock CRP: Focal point animal health at ILRI, cluster leader in the Livestock Health Flagship

Livestock Feeds and Forages Flagship – Key scientists (10)

Name: Michael BLÜMMEL

Current position and affiliation: Team Leader, Feeds and Forages, International Livestock Research Institute (ILRI)

Profile: Animal nutritionist with more than 25 years of experience in teaching, development, research and research management in Europe, US, Africa and Asia. Major research and development interests are feeding and feed resourcing at the interface of positive and negative effects from livestock, multi-dimensional crop improvement, crop-livestock interactions and small scale business enterprises around feed and fodder. More than 250 scientific publications, about half peer reviewed. Current Google Scholar Rating: h-index 28; > 4600 citations

Employment:

1999-2001: Research Scientist, USDA ARS Livestock and Range Research Laboratory, Montana, USA

1996-1999: Habilitand, University of Hohenheim, Germany

1993-1996: Lecturer in in Animal Science, GTZ, Bunda College, Malawi

Education:

2004, Habilitation, Animal Nutrition, University of Hohenheim, Germany

1994, Doctor of Science, Animal Nutrition, University of Hohenheim, Germany

Selected Recent Peer-reviewed publications

- Okike, I., Samireddypalle, A., Kaptoge, L., Fauquet, C., Atehnkeng, J., Bandyopadhyay, R., Kulakow, P., Duncan, A.J., Alabi, T. and Blummel, M. 2015. Technical innovations for small-scale producers and households to process wet cassava peels into high quality animal feed ingredients and aflasafe™ substrate. *Food Chain* 5(1-2): 71-90
- Blümmel, M., Steele, B. and Dale, B.E. 2015. Opportunities from second-generation biofuel technologies for upgrading lignocellulosic biomass for livestock feed. *CAB Reviews* 9 (041).
- Blümmel, M., Deshpande, S., Kholova, J. and Vadez, V. 2015. Introgression of staygreen QLT's for concomitant improvement of food and fodder traits in Sorghum bicolor. *Field Crops Research* 180: 228–237.
- Blümmel, M., Hailelassie, A., Samireddypalle, A., Vadez, V. and Notenbaert, A. 2014. Livestock water productivity: Feed resourcing, feeding and coupled feed-water resource data bases. *Animal Production Science* 54(10): 1584-1593.
- Blümmel, M., Grings, E. and Erenstein, O. 2013. Potential for dual-purpose maize varieties to meet changing maize demands: Synthesis. *Field Crops Research* 153: 107-112.
- Blümmel, M., Homann-Kee Tui, S., Valbuena, D., Duncan, A.J. and Herrero, M. 2013. Biomass in crop-livestock systems in the context of the livestock revolution. *Sécheresse* 24(4): 330 – 339.
- Herrero, M., Havlík, P., Valin, H., Notenbaert, A., Rufino, M.C., Thornton, P.K., Blümmel, M., Weiss, F., Grace, D. and Obersteiner, M. 2013. Biomass use, production, feed efficiencies, and greenhouse gas emissions from global livestock systems. *PNAS* 110(52): 20888-20893

Other Evidence of Leadership, large-program management and delivery: Flagship Leader Feed and Forages in Livestock and Fish CRP and Team Leader of ILRI. Research management experience in Africa and Asia with associated grant acquisition in the past decade of 2 BMZ Full Proposals, 2 ACIAR Research Proposals, 3 DFID Proposals, 2 Government of India Proposals, 2 BMGF/USAID Grant and numerous smaller < 100 000 US \$ / year proposals. Head of ILRI station hosted by ICRISAT in India 2001 to 2015.

Role in Livestock CRP: leads Livestock Feeds and Forages Flagship, Cluster 3.

Name: Alan DUNCAN

Current position and affiliation: Principal Livestock Scientist, International Livestock Research Institute (ILRI)

Profile: Duncan is an expert in ruminant nutrition and livestock systems. He has conducted work on a wide range of topics related to livestock feeding in developing countries. He has led the development of participatory tools for targeting feed interventions including the Feed Assessment Tool (FEAST) and Techfit (for prioritization of feed interventions).

Employment:

2007- present: Principal Livestock Scientist, International Livestock Research Institute, Ethiopia

1993 – 2007: Research scientist, Macaulay Institute, United Kingdom

Education:

1990, PhD in Ruminant Nutrition, University of Aberdeen

1986, MSc in Animal Production, University of Edinburgh

Selected Recent Peer-reviewed publications:

- Mekasha, A., Gerard, B., Tesfaye, K., Nigatu, L., and Duncan, A.J. 2014. Inter-connection between land use/land cover change and herders'/farmers' livestock feed resource management strategies: a case study from three Ethiopian eco-environments. *Agriculture Ecosystems and the Environment* 188: 150-162.
- Duncan, A.J., Teufel, N., Mekonnen, K., Singh, V.K., Bitew, A. and Gebremedhin, B. 2013. Dairy intensification in developing countries: effects of market quality on farm-level feeding and breeding practices. *Animal* 7: 2054-2062.
- Duncan, A.J., Tarawali, S.A., Thorne, P.J., Valbuena, D., Descheemaeker, K. and Homann-Kee Tui, S. 2013. Integrated crop livestock systems - a key to sustainable intensification in Africa. *Tropical Grasslands* 1: 202-206.
- Stur, W.W., Khanh, T.T. & Duncan, A.J. 2013. Transformation of smallholder beef cattle production in Vietnam – technology, innovation and markets. *International Journal of Agricultural Sustainability* 11: 363-381.
- Duncan, A.J., York, L., Lukuyu, B., Samaddar, A. and Stur, W.W. FEAST: Feed Assessment Tool. 2012. ILRI

Other Evidence of Leadership, large-program management and delivery:

2010 – 2013 - [Nile Basin Development Challenge](#). Basin Leader for this research for development programme funded by Challenge Programme for Water and Food (6 M USD)

2013-2014 – Global Lead for CRP Humidtropics Strategic Research Theme on Systems Analysis and Synthesis

2011 – 2014 - [Enhancing Dairy-based Livelihoods in India and the United Republic of Tanzania through Feed Innovation and Value Chain Development Approaches](#). Co-ordinator of IFAD funded project. (1 M USD)

Role in Livestock CRP: Livestock Feeds and Forages Flagship: Livestock Feeds expert, development of participatory tools.

Name: Chris JONES

Current position and affiliation: Program Leader, Feed and Forage Biosciences Program, International Livestock Research Institute (ILRI)

Profile: A plant biotechnologist with interests spanning a broad range of modern biotechnologies, with the aim of developing rigorous analytical techniques to identify and exploit new and improved target traits and to apply these capabilities to accelerate the development of forage cultivars and endophytes.

Employment:

2011-2015 Forage Improvement Science Team Leader, AgResearch, NZ.
 2004-2011 Forage Biotechnology Science Manager, AgResearch, NZ.
 2003-2004 Pastoral Genomics Project Leader, AgResearch, NZ.
 2000-2003 Molecular Sciences Manager, Fletcher Challenge Forests, Te Teko, NZ.

Education:

2000, PhD in plant molecular biology, University of Dundee
 1990, BSc in biological sciences, Portsmouth Polytechnic

Selected Recent Peer-reviewed publications:

- Roche J, Love J, Guo Q, Song J, Fraser K, Cao M, Jones C, Novak O, Turnbull MH and Jameson PE. 2016. Metabolic changes and associated cytokinin signals in response to nitrate assimilation in roots and shoots of *Lolium perenne* L. *Physiologia Plantarum*, doi: 10.1111/ppl.12412.
- Liu Q, Jones CS, Parsons AJ, Xue H and Rasmussen S. (2015). Does gibberellin biosynthesis play a critical role in the growth of *Lolium perenne*? Evidence from a transcriptional analysis of gibberellin and carbohydrate metabolic genes after defoliation. *Frontiers in Plant Science*, 6: 944.
- Hunt, C.L., Jones, C.S., Koolaard, J.P., West, J., Hatier, J.H.B. 2015. Estimation in the field of individual perennial ryegrass plant position and dry matter yield using a custom made high-throughput image analysis tool. *Crop Science* <http://dx.doi.org/10.2135/cropsci2015.02.0125>.
- Jones, C.S., Hatier, J.-H.B., Cao, M., Fraser, K. and Rasmussen, S. 2015. Metabolomics of plant P-starvation response. IN: Plaxton, W. and Lambers, H. 2015. Annual plant reviews, volume 48: Phosphorus metabolism in plants. New York: Wiley. <http://dx.doi.org/10.1002/9781118958841.ch8>.
- Liu, Q., Parsons, A.J., Xue, H., Jones, C.S. and Rasmussen, S. 2015. Transcriptional regulation of phosphate transporters from *Lolium perenne* and its mycorrhizal symbionts in response to phosphorus supply. *Functional Plant Biology* 42: 1-8.
- Hatier, J.H.B., Faville, M.J., Hickey, M.J., Koolaard, J.P., Schmidt, J., Carey, B.-L. and Jones, C.S. 2014. Plant vigour at establishment and following defoliation are both associated with responses to drought in perennial ryegrass (*Lolium perenne* L.). *Journal of Experimental Botany* 65: 5823–5834.
- Rasmussen, S., Parsons, A.J., Xue, H., Liu, Q., Jones, C.S., Ryan, G. and Newman J.A. 2014. Transcript profiling of fructan biosynthetic pathway genes reveals association of a specific fructosyltransferase isoform with the high sugar trait in *Lolium perenne*. *Journal of Plant Physiology* 171: 475–485.

Other Evidence of Leadership, large-program management and delivery: As Forage Biotechnology Science Manager, provided leadership for a multi-disciplinary group of over 70 scientific and administrative staff (and over 300 staff as acting GM in 2009 - 2010) located in 5 locations across New Zealand. Coordinated science planning, contracting and delivery of a NZD 7M pa 'forage plant genomics' program and a NZD 2.6M pa industry-led forage biotech consortium. Appointed to the consortiums Scientific Advisory Panel the management group of the molecular mapping program.

Role in Livestock CRP: Livestock Feeds and Forages Flagship, leads cluster 1.

Name: Mounir LOUHAICHI

[SEE ENVIRONMENT SCIENTISTS]

Name: Solomon MWENDIA

Current position and affiliation: Forage Agronomist, International Center for Tropical Agriculture (CIAT)

Profile: Mwendia works with smallholder dairy farmers promoting integration of forages under mixed crop-livestock systems in Kenya and Tanzania. Further involved in assisting implementation of participatory forages research with National Agriculture Research Systems (NARS) in Mozambique,

Tanzania and Uganda. Has contributed to development and promotion of the major fodder resource, Napier grass, for smallholder dairy systems while working for NARS in Kenya. He has published or co-authored journal articles, conference papers and posters.

Employment:

2015-2016, Post-doctoral scientist, International Center for Tropical Agriculture (CIAT), Kenya

2007-2014, Research Officer, Kenya Agricultural and Livestock Research Organization, Kenya

2000-2006, Research Assistant, Kenya Agricultural and Livestock Research Organization, Kenya

Education:

2015, PhD in Forage Agronomy, University of New England, Australia

2007, MSc in Livestock Production Systems, University of Nairobi, Kenya

Selected Recent Peer-reviewed publications:

- Mwendia S.W., Yunusa I.A.M., B.M. Sindel, R.D.B. Whalley and Kariuki I. W. (2016). Assessment of Napier grass accessions in lowland and highland tropical environments in East Africa: Productivity and forage quality. *Experimental Agriculture*
- Mwendia S.W., I. Yunusa, R.D.B. Whalley, B. Sindel, D. Kenny and I. Kariuki (2013). Use of plant water relations to assess forage quality and growth of two cultivars of Napier grass (*Pennisetum purpureum*) subjected to different levels of soil water supply and temperature regimes. *Crop and Pasture Science*, 64, 1008—1019.
- Mwendia S.W., Mwangi D.M, Wahome R.G. and Wanyoike M., (2008). Assessment of growth rate and yields of three napier grass varieties in Central highlands of Kenya. *East Africa Agriculture and Forestry Journal* 74, 211–217
- Mwendia S.W., Wanyoike M., J.G.M. Njuguna, Wahome R.G. and Mwangi D.M (2007). Effect of Napier Head Smut Disease on Napier yields and the disease coping strategies in farming systems in Central Kenya. *Livestock Research for Rural Development* 19(8)
- Mwendia S.W., Wanyoike M., J.G.M. Njuguna, Wahome R.G. and Mwangi D.M (2006). Farmers' perceptions on importance and constraints facing Napier grass production in Central Kenya *Livestock Research for Rural Development* 18(11)

Role in Livestock CRP: Livestock Feeds and Forages Flagship, cluster 2

Name: Abdoul Aziz NIANE

Current position and affiliation: Scientist (Seed and rangeland ecology), Biodiversity and Integrated Gene Management Program, International Center for Agricultural Research in Dry Areas (ICARDA)

Profile: Niane has over 25 years of experience working on seed science and technology and rangeland monitoring, restoration and management issues, involving community-based rehabilitation. Currently he is a seed scientist leading the ICARDA International Nurseries group contributing to several bilateral projects on crop livestock integration as alternative seed system analysis and diversification specialist. He contributed to implementation of several rangeland and wild life rehabilitation projects in Syria, Libya and Afghanistan with special emphasis on developing alternative seed delivery systems for forage and pasture seed. He has authored and co-authored several scientific and technical publications including peer reviewed papers, conference proceedings and training manuals

Employment:

1997 to 2010, Research Associate, ICARDA

1986 to 1997, Senior Research Assistant, ICARDA

Education:

2013, PhD rangeland ecology, Wageningen University

1992, MSc in Plant Protection, University of Çukorova, Adana, Turkey

Selected Recent Peer-reviewed Publications

- Niane, A.A., Paul C. Struick and Zewdie Bishaw. 2014. Bayesian Estimation of Shrub Diversity in Rangelands under Two Management Systems in Northern Syria. *Open Journal of Ecology* 4: 163-173.
- Niane, A.A., Paul C. Struick and Zewdie Bishaw. 2013. Effects of Temperature, Relative Humidity and Moisture Content on Seed Longevity of Shrubby Russian Thistle (*Salsola vermiculata* L.). *Journal of Agricultural Science and Technology B* 3: 623-634
- Tavva Srinivas; Zewdie Bishaw; Javed Rizvi; Abdoul Aziz Niane; Abdul Rahman Manan; Koffi Amegbeto. 2010. ICARDA'S Approach in Seed Delivery: Technical Performance and Sustainability of Village-Based Seed Enterprises in Afghanistan. *Journal of New Seeds* 11(2): 138 – 163.
- Ghassali, F., Salkini, A.K., Petersen, S.L., Niane, A.A., and Louhaichi, M. 2012. Germination dynamics of Acacia species under different seed treatments. *Range Management and Agroforestry Journal* 33(1): 37-42.
- Singh, M., Niane, A.A. and Chaubey, Y.P. 2010. Evaluating Uniformity of Plant Varieties: Sample Size for Inference on Coefficient of Variation. *Journal of Statistics and Applications*.

Other Evidence of Leadership, large-program management and delivery: From 2007-2016, led ICARDA International Nurseries seed production and post-harvest seed operation in Lebanon; from 2008-2010, led the seed component of the Water productivity improvement of cereals and foods legumes in the Atbara Basin of Eritrea

Role in Livestock CRP: Contribute seed system development and diversification inputs to Livestock Feeds and Forages Flagship clusters 3 and 4.

Name: Idupulapati RAO

Current position and affiliation: Plant Nutritionist and Physiologist, International Center for Tropical Agriculture (CIAT)

Profile: Rao is a plant nutritionist and physiologist. The main focus of his work is on physiological aspects of abiotic stress adaptation in common beans and tropical forages. With extensive experience in stress physiology of tropical crops and forage plants, particularly to nutrients and water, he has helped to identify and develop common bean and tropical forage genotypes that are adapted to low fertility soils and drought in the tropics. These genotypes are an integral part of sustainable intensification of climate-smart crop-livestock systems in the savannas and hillsides agroecosystems of the tropics. He is author or co-author of over 150 refereed journal articles, 58 book chapters, 63 articles in conference proceedings, and 222 oral or poster summaries. He has also co-edited three books and co-directed the field research of Ph.D. (16), Masters (8), and undergraduate (14) students enrolled in universities of Germany, USA, Austria, Switzerland, Norway, Spain, and Colombia.

Employment:

1984–1989, Assistant Specialist, University of California, Berkeley, USA

1982–1984, Research Associate, University of Illinois, Urbana-Champaign, USA

1981–1982, Research Associate, University of Illinois, Chicago, USA

Education:

1978, PhD in Plant Physiology, Sri Venkateswara University, India

1973, MSc in Botany, Bhopal University, India

Selected Recent Peer-reviewed publications:

- Mutimura, M., Ebong, C., Rao, I.M., and Nsahlai, I.V. 2016. Changes in intake and body weight of crossbred (Ankole × Jersey) dairy heifers fed on cut-and-carry forage system of *Brachiaria*

grass or Napier grass supplemented with commercial concentrates. *Tropical Animal Health and Production* (in press).

- Rudel, T.K., Kwon, O.J., Paul, B., Boval, M., Rao, I.M., Burbano, D., McGroddy, M., Lerner, A., White, D., Cuchillo, M., Luna, M., and Peters, M. 2016. Does mixed crop – livestock farming encourage sustainable agricultural practices? A meta-analysis. *Land* (in press).
- Mutimura, M., Ebong, C., Rao, I.M., and Nsahlai, I.V. 2015. Nutritional values of available ruminant feed resources in smallholder dairy farms in Rwanda. *Tropical Animal Health and Production* 47: 1131-1137.
- Mutimura, M., Ebong, C., Rao, I.M. and Nsahlai, I.V. 2015. Nutritional values of available ruminant feed resources in smallholder dairy farms in Rwanda. *Tropical Animal Health and Production* 47: 1131-1137.
- Araújo, S.S., Beebe, S., Crespi, M., Delbreil, B., González, E.M., Gruber, V., Lejeune-Henaut, I., Link, W., Monteros, M.J., Prats, E., Rao, I., Vadez, V. and Vaz Patto, M.C. 2015. Abiotic stress responses in legumes: Strategies used to cope with environmental challenges. *Critical Reviews in Plant Sciences* 34: 237-280.
- Rao, I.M. 2014. Advances in improving adaptation of common bean and *Brachiaria* forage grasses to abiotic stresses in the tropics. IN: Pessaraki, M. 2014. Handbook of plant and crop physiology. London: CRC Press: 847-889.

Other Evidence of Leadership, large-program management and delivery: Major role in various projects, eg: LivestockPlus: Supporting low emissions development planning in the Latin American cattle sector. CCAFS-CGIAR Research Program; Innovative programmatic approach to climate change in support of BecA's mission: Climate-smart *Brachiaria* grasses for improving livestock production in East Africa. Sida, Sweden; Climate-smart crop-livestock systems for smallholders in the tropics: Integration of new forage hybrids to intensify agriculture and to mitigate climate change through regulation of nitrification in soil. BMZ-GIZ, Germany.

Role in Livestock CRP: Scientist in the Livestock Feeds and Forages Flagship, cluster 2.

Name: Udo RÜDIGER

Current position and affiliation: Agricultural Innovation Specialist, Sustainable Intensification and Resilient Production Systems Program, International Center for Agricultural Research in Dry Areas (ICARDA)

Profile: Rüdiger has 20 years experience in Sub-Sahara Africa, of which he spent 10 years in the field of agribusiness cluster and value chain development, five years of lecturing at a college, three years of training local NGO in project management and two years in a natural resource management project. Before joining ICARDA in January 2016 he worked at the International Fertilizer Development Center (IFDC) as regional agribusiness cluster development specialist covering Rwanda, Burundi, Uganda and Eastern Congo. His earlier work as national agribusiness coordinator in Togo involved the coordination of project activities to render value chains of selected commodities (maize, soybean, rice, cassava, Irish potatoes, chili pepper, etc) more competitive. The establishment of local agribusiness clusters and innovation platforms addressing key constraints with stakeholders from the civil society, private and public sector was another area of work.

Employment:

2012-2015, Regional Agribusiness Cluster Development Specialist, Rwanda (Burundi, DRC), International Fertilizer Development Center

2006-2011, National Coordinator of a value chain project, Togo, International Fertilizer Development Center

2001-2004, Technical Assistant, Income Generating Project, Benin, DED (German Development Service)

1999-2001, Technical Assistant, Natural Resource Management Project, Burkina Faso, DED (German Development Service)

Education:

1989. *Master of Agronomy* in International Agriculture, University of Kassel, Germany

Selected Recent Peer-reviewed publications:

- Maatman, A., Rudiger, U., et.al. 2011. Competitive Agricultural Systems and Enterprises (CASE); A grassroots' approach to agribusiness development in Sub Sahara Africa; Volume 1: Reference framework and early experience. Wageningen: CTA and IFDC.

Other Evidence of Leadership, large-program management and delivery: At IFDC, developed and implemented a regional agribusiness cluster and megacluster approach; Coordination of 27 agribusiness clusters in Togo and 15 Megaclusters in Eastern Africa (Rwanda, Burundi, DRC). Successful introduction of yellow maize varieties produced by farmer organizations for poultry markets in Togo, Rwanda and Burundi in collaboration with NARES, Pan African seed Company SeedCo and MFIs.

Role in Livestock CRP: Focal point in Tunisia; leads Livestock Feeds and Forages Flagship, cluster 4.

Name: Margaret WORTHINGTON

Current position and affiliation: Forage Breeder, International Center for Tropical Agriculture (CIAT)

Profile: Worthington conducted her graduate research on the breeding and genetics of common bean and wheat before joining CIAT as a tropical forage breeder. For the past two years she has been working with experienced tropical forage breeder John Miles to introduce modern phenotyping platforms and genomic tools to the CIAT Brachiaria breeding program. To date Worthington has authored four successful grants and ten peer-reviewed publications. Her experiences working in the US, India, and Colombia have made her comfortable and effective in communicating agricultural research to a diverse audience. While at CIAT she has led an applied Brachiaria cultivar development program, defined new research problems, and developed a research plan that has resulted in a number of positive achievements including: construction of the first saturated genetic linkage maps of tetraploid and hexaploid Brachiaria species using genotyping-by-sequencing, identification of flanking SNP markers linked to the apomixis locus and QTL associated with aluminum resistance in Brachiaria decumbens, and draft assembly of a diploid Brachiaria ruziziensis reference genome.

Employment:

2010–2013 Graduate Research Assistant, North Carolina State University, USA

2008–2010 Graduate Research Assistant, University of California, Davis, USA

2006–2007 US Fulbright Fellow, Institute of International Education, India

Education:

2014, PhD in Crop Science, North Carolina State University

2010, MSc in International Agricultural Development and Horticulture and Agronomy, University of California

Selected Recent Peer-reviewed publications:

- Worthington, M.L. and Miles, J.W. 2015. Reciprocal full-sib recurrent selection and tools for accelerating genetic gain in apomictic Brachiaria. IN: Budak, H. and Spangenberg, G. 2015. Molecular breeding of forage and turf: The Proceedings of the 8th International Symposium of Molecular Breeding of Forage and Turf. Heidelberg: Springer: 19-30.
- Worthington, M., Reberg-Horton, S.C., Brown-Guedira, G., Jordan, D., Weisz, R. and Murphy, J.P. 2015. Morphological traits associated with superior weed suppressive ability of winter wheat against Italian ryegrass. Crop Science 55: 50-56. <http://dx.doi.org/10.2135/cropsci2014.02.0149>.
- Worthington, M., Lyerly, J., Petersen, S., Brown-Guedira, G., Marshall, D., Cowger, C., Parks, R. and Murphy, J.P. 2014. Genetic mapping of MIUM15: An Aegilops neglecta-derived powdery mildew resistance gene in common wheat. Crop Science 54: 1397-1406.

- Worthington, M. and Reberg-Horton, S.C. 2013. Breeding cereal crops for enhanced weed suppression: Optimizing allelopathy and competitive ability. *Journal of Chemical Ecology* 39: 213-231. <http://dx.doi.org/10.1007/s10886-013-0247-6>.
- Worthington, M., Soleri, D., Aragón-Cuevas, F. and Gepts, P. 2012. Genetic composition and spatial distribution of farmer-managed Phaseolus bean plantings: An example from a village in Oaxaca, Mexico. *Crop Science* 52: 1721-1735. <http://dx.doi.org/10.2135/cropsci2011.09.0518>.

Other Evidence of Leadership, large-program management and delivery: Leading CIATs Tropical Forage Breeding programs

Role in Livestock CRP: leads Livestock Feeds and Forages Flagship, Cluster 2

Name: Ewa WREDLE

Current position and affiliation: Associate Professor, Animal Sciences, Swedish University of Agricultural Sciences (SLU)

Profile: Wredle's major research area is animal husbandry, including feeding/grazing, management and milking routines, for small and large ruminants. She works with integrated small scale farming system in Vietnam, Laos and Cambodia as well as agro-pastoral livestock systems in Uganda, Tanzania and Kenya. A major part of her interest is capacity development/building in low-income countries.

Employment:

2005-2009, Researcher, Swedish University of Agricultural Sciences (SLU), Sweden

Education:

2005, PhD in Animal Science, Swedish University of Agricultural Sciences, Sweden

2001, MSc in Animal Science. Swedish University of Agricultural Sciences, Sweden

Selected Recent Peer-reviewed publications:

- Johansson, C., Wredle, E., Mpairwe, D., Sabiiti, E. and Spörndly, E. 2015. Effects of calving month, pasture conditions and management on the growth of Holstein-Friesian × Ankole crossbred calves in a semi-arid rangeland. *Tropical Animal Health and Production* 47(4): 783-786
- Wredle, E., Östensson, K., and Svennersten-Sjaunja, K. 2015. The effect of pasture turnout on milk somatic cell count, polymorphonuclear leukocytes and milk composition in cows housed in tie stalls. *Acta Agriculturae Scandinavica, Section A — Animal Science* 64(4)
- Patel, M., Wredle, E. and Bertilsson, J. 2013. Effect of dietary proportion of grass silage on milk fat with emphasis on odd- and branched chain fatty acids in dairy cows. *Journal of Dairy Science* 99: 390-397.
- Hue, K.T., Van, D.T.T., Wredle, E., Ledin, I. and Spörndly, E. 2012. Effect of harvesting frequency, variety and leaf maturity on nutrient composition, hydrogen cyanide content and cassava foliage yield. *Asian-Australian Journal of Animal Science* 25: 1691-1700.
- Kongmanila, D., Bertilsson, J., Ledin, I. and Wredle, E. 2012. Effect of feeding different levels of foliage from *Erythrina variegata* on the performance of growing goats. *Tropical Animal Health and Production* 44: 1659-1665.

Other Evidence of Leadership, large-program management and delivery: Assistant Head of SLU department Animal Nutrition and Management; Theme leader at SLU Global on Restoration of degraded rural landscapes; Coordinator for SLU regional capacity building program in SE Asia; coordinator for SLU bilateral capacity building program in Rwanda.

Role in Livestock CRP: Contribute to Livestock Feeds and Forages Flagship, clusters 3 and 4.

Livestock and the Environment Flagship – Key scientists (9)

Name: Jacobo ARANGO

Current position and affiliation: Scientist, Tropical Forages Program, International Center for Tropical Agriculture (CIAT)

Profile: Arango has worked for four on nitrogen cycling processes in tropical forage-based crop-livestock systems with a particular focus on Biological Nitrification Inhibition (BNI) to reduce nitrous oxide emissions and improve nitrogen use efficiency. He is also working on improving forage quality characteristics and their impact on reducing methane emissions from cattle. Additionally he is also investigating the role of improved forages in crop-livestock systems in enhancing soil health (including soil carbon sequestration).

Employment:

2012-2015, Post-doctoral Researcher / CIM returning expert, CIAT, Colombia.

2010-2012, Post-doctoral Research Associate, Michigan State University, USA.

2006-2010, Research Associate, Albert Ludwigs University of Freiburg. Germany.

Education:

2010, PhD, Albert Ludwigs University of Freiburg, Germany.

2006, Biologist, Pontificia Universidad Javeriana, Colombia.

Selected Recent Peer-reviewed publications:

- Rao, I.M. et al. 2015. LivestockPlus – The sustainable intensification of forage-based agricultural systems to improve livelihoods and ecosystem services in the tropics. *Tropical Grasslands – Forrajes Tropicales* 3: 59-82.
- González R, ... **Arango J**, et al. 2015 Limitations to implementing greenhouse gas mitigation actions in livestock systems in Latin America. *Livestock Research for Rural Development* 27: #249.
- **Arango, J.**, D. Moreta, J. Nuñez, K. Hartmann, M. Dominguez, M. Ishitani, J. Miles, G. Subbarao, M. Peters and I. Rao. 2014. Developing methods to evaluate phenotypic variability in Biological Nitrification Inhibition (BNI) capacity of Brachiaria grasses. *Tropical Grasslands – Forrajes Tropicales* 2: 6-8.
- **Arango J**, Jourdan M, Geoffriau E, Beyer P and Welsch R. 2014. Carotene hydroxylase activity determines both α -carotene and total carotenoid amounts in orange carrots. *The Plant Cell* 26(5): 2223-2233.
- Moreta, D. E., Arango, J. et al. 2014. Biological nitrification inhibition (BNI) in Brachiaria pastures: A novel strategy to improve eco-efficiency of crop-livestock systems and to mitigate climate change. *Tropical Grasslands – Forrajes Tropicales* 2: 88-91.
- Maass D, **Arango J**, Wüst F, Beyer P and Welsch R. 2009. Carotenoid Crystal Formation in Arabidopsis and Carrot Roots Caused by Increased Phytoene Synthase Protein Levels. *PLoS ONE* 4(7): e6373.

Other Evidence of Leadership, large-program management and delivery: Coordinator of a four year project (2012-2015) on climate-smart crop-livestock systems for smallholder agriculture, with a budget of approximately US\$1.5 million in total funds (BMZ/GIZ). Coordinator of four year project (2015-2018) with a budget of approximately US\$2.4 million in total funds (CCAFS-CRP) supporting low emissions development planning in cattle sector (NAMAs) of Colombia and Costa Rica.

Role in Livestock CRP: Livestock and the Environment Flagship; also contributes to Livestock Feeds and Forages Flagship.

Name: Klaus BUTTERBACH-BAHL

Current position and affiliation: Principal scientist, International Livestock Research Institute (ILRI) and Research professor, Karlsruhe Institute of Technology, Germany

Profile: Butterbach-Bahl has more than two decades of experimental and modelling experience working on biosphere-atmosphere-hydrosphere exchange processes of environmental important trace substances such as greenhouse gases (GHG). He has previously worked on the establishment of GHG footprints of livestock production systems for CCAFS.

Employment:

1993-2001, Scientist/ Senior Scientist Fraunhofer Institute Atmospheric Environmental Research
2002-, Group Leader, Head of Department, Karlsruhe Institute of Technology (KIT), Institute of Meteorology and Climate Research, Atmospheric Environmental Research, Germany

Education:

1992, PhD, Technical University Munich, Germany
2002, Habilitation, Soil Ecology, Albert Ludwigs University of Freiburg, Germany.

Selected Recent Peer-reviewed publications:

- Arias-Navarro, C., Díaz-Pinés, E., Kiese, R., Rosenstock, T.S., Rufino, M.C., Stern, D., Neufeldt, H., Verchot, L.V. and Butterbach-Bahl, K. 2013, Gas pooling: A sampling technique to overcome spatial heterogeneity of soil carbon dioxide and nitrous oxide fluxes. *Soil Biology and Biogeochemistry* 67: 20-23.
- Butterbach-Bahl, K. and Kiese R. 2013. Biofuel production on the margins. *Nature* 493: 483-485.
- Ogle, S.M., Buendia, L., Butterbach-Bahl, K., Breidt, F.J., Hartman, M., Yagi, K., Nayamuth, R., Spencer, S., Wirth, T. and Smith, P. 2013. Advancing national greenhouse gas inventories for agriculture in developing countries: Improving activity data, emission factors and software technology. *Environmental Research Letters* 8(1). <http://dx.doi.org/10.1088/1748-9326/8/1/015030>
- Rosenstock, T.S., Rufino, M.C., Butterbach-Bahl, K. and Wollenberg, E. 2013. Toward a protocol for quantifying the greenhouse gas balance and identifying mitigation options in smallholder farming systems. *Environmental Research Letters* 8(2). <http://dx.doi.org/10.1088/1748-9326/8/2/021003>
- Zhou, M., Brandt, P., Pelster, D., Rufino, M.C., Robinson, T. and Butterbach-Bahl, K. 2014. Regional nitrogen budget of the Lake Victoria Basin, East Africa: syntheses, uncertainties and perspectives. *Environmental Research Letters* 9(10). <http://dx.doi.org/10.1088/1748-9326/9/10/105009>.

Role in Livestock CRP: Livestock and the Environment Flagship

Name: Mats LANNERSTAD

Current position and affiliation: Senior Scientist, Livestock Systems and the Environment (LSE), International Livestock Research Institute (ILRI), Nairobi

Profile: Lannerstad has more than 15 years of research on use of water and other natural resources in agriculture. He is currently active in the Livestock and Fish and the Water, Land and Ecosystems CRPs, mainly working on environmental and natural resources research, including developing a new framework for environmental impact assessments from livestock production, applying a novel approach to assess and improve the use of water in livestock production systems, and formulating strategies for biomass trade-offs at landscape scale.

Employment:

2012-2014, Scientist, Livestock and Water, International Livestock Research Institute (ILRI)
2009-2014, Research Fellow, Stockholm Environment Institute (SEI), Stockholm.
2005-2011, Project Consultant, Lannerstad Water

2003-2009, Research Scholar, Department of Environmental Studies, Linköping University, Linköping, Sweden.

Education:

2009, PhD in Water and Environmental Science, Department of Water and Environmental Studies (DWES), Linköping University, Sweden.

2002, MSc in Environmental Engineering and Sustainable Infrastructure, Royal Institute of Technology (KTH), Stockholm, Sweden.

1999, MSc in Biology, with specialization in Limnology/Freshwater Ecology, Lund University, Sweden.

Selected Recent Peer-reviewed publications:

- Ran, Y., Lannerstad, M., Herrero, M., van Middelaar, C.E., and de Boer I.J.M. 2016 Assessing water resource use in livestock production: A review of methods *Livestock Science*
- Lannerstad, M., Falkenmark, M. and Heinke, J. 2014. Food production: A mega water challenge. IN: Rockström, J., Falkenmark, M., Folke, C., Lannerstad, M., Barron, J., Enfors, E. Gordon, L., Heinke, J., Hoff, M., and Pahl-Wostl, C. 2014. *Water Resilience for Human Prosperity*. Cambridge: Cambridge University Press.
- Ran, Y., Deutsch, L., Lannerstad, M. and Heinke, J. 2013. Rapidly intensified beef production in Uruguay - Impacts on water-related ecosystem services. *Aquatic Proceedia* 1: 77–87.
<http://dx.doi.org/10.1016/j.aqpro.2013.07.007>
- Rockström, J., M. Falkenmark, M. Lannerstad, and L. Karlberg. 2012 The planetary water drama: Dual task of feeding humanity and curbing climate change. *Geophysical Research Letters* 39.
<http://dx.doi.org/10.1029/2012GL051688>
- Rockström, J., Lannerstad, M. and Falkenmark, M. 2007. Assessing the Water Challenge of a New Green Revolution in Developing Countries. *PNAS* 104: 6253-6260.

Other Evidence of Leadership, large-program management and delivery: ILRI Science Focal Point, Flagship System Analysis for Sustainable Innovation, Livestock and Fish CRP; ILRI Science Focal Point, WLE CRP. PI of several projects.

Role in Livestock CRP: Livestock and the Environment Flagship, cluster 2 activity leader on sustainable water solutions; focal point for collaborations with IWMI and CRP WLE.

Name: Mounir LOUHAICHI

Current position and affiliation: Principal Scientist (Rangeland Ecologist) and team leader, Rangeland Ecology and Management Unit, International Center for Agricultural Research in Dry Areas (ICARDA)

Profile: Louhaichi has a proven track record of more than 25 years in ecological rehabilitation and restoration and landscape ecology. He has a solid background in assessing and monitoring rangeland health using advanced geospatial tools (certified GIS Professional). He has authored and co-authored more than 100 scientific and technical publications including peer reviewed papers, conference proceedings, training manuals and copyrighted / patented scientific software and hardware.

Employment:

2008–2012, Senior rangeland scientist, ICARDA, Syria

2002–2008, Faculty research associate, Oregon State University

1995-2001, Graduate Research Assistant, Oregon State University

1994–1995, US Hubert Humphrey Fellow, Cornell University

Education:

2002, PhD in Range Ecology and Management, Oregon State University

1999, MSc in landscape ecology, Oregon State University

Selected Recent Peer-reviewed publications:

- Mahyou, H., Bernard, T., Balaghi, R., Louhaichi, M., and Mimouni, J. 2016. A Knowledge-Based Approach for Mapping Land Degradation in the Arid Rangelands of North Africa. *Land Degradation and Development*. doi: 10.1002/ldr.2470.
- Porqueddu, C., S. Ates, M. Louhaichi, A.P. Kyriazopoulos, G. Moreno, A. del Pozo, C. Ovalle, M.A. Ewing and P.G.H. Nichols. 2016. Grasslands in 'Old World' and 'New World' Mediterranean climate zones: past trends, current status and future research priorities *Grass and Forage Science* 71: 1-35
- Mirzabaev, A., Ahmed, M., Werner, J., Pender, J., and Louhaichi, M. 2016. Rangelands of Central Asia: challenges and opportunities. *Journal of Arid Land* 8(1): 93–108
- Louhaichi, M., Johnson M.D., Woerz A.L., Jasra W. and Johnson D.E. 2010. Digital charting technique for monitoring rangeland vegetation cover at local scale. *International Journal of Agricultural Biology* 12: 406-410.
- Meier, J.S., Liesegang, A., Louhaichi, M., Hilali, M., Rischkowsky, B., Kreuzer, M. and Marquardt, S. 2014. Intake pattern and nutrient supply of lactating sheep selecting forage from woody plants and straw offered in binary or multiple choices. *Animal Feed Science and Technology* 188: 1-12.
- Ouled Belgacem Azaiez and M. Louhaichi. 2013. The vulnerability of native rangeland plant species to global climate change in the West Asia and North African regions. *Climatic Change* ISSN 0165-0009
- Louhaichi, M., F. Ghassali, A. K. Salkini, and S. L. Petersen. 2012. Effect of sheep grazing on rangeland plant communities: Case study of landscape depressions within Syrian arid steppes. *Journal of Arid Environments* 79: 101-106

Other Evidence of Leadership, large-program management and delivery: FAO-ICARDA Cactus network: Deputy General Coordinator since 2013; International Rangeland Congress: Elected member of the continuing committee since 2011 covering the MENA region

Role in Livestock CRP: Livestock and Environment Flagship, cluster 2 activity leader on rangeland restoration; contributes to the Livestock Feeds and Forages Flagship.

Name: Lutz MERBOLD

Current position and affiliation: Senior scientist, International Livestock Research Institute (ILRI)

Profile: Merbold's research focuses on the detailed understanding of greenhouse gas exchange (H₂O, CO₂, N₂O and CH₄) in a variety of ecosystems worldwide including managed grasslands, livestock systems, woodlands, forests, savannas and wetlands. By applying micrometeorological methods such as the eddy covariance technique I aim to define major meteorological as well as biological factors influencing ecosystem greenhouse gas (GHG) fluxes and link the biogeochemical cycles of carbon, nitrogen and water. Besides studying the ecosystem scale, he is further investigating the exchange of GHGs at the process level (leaf and soils using GHG chambers) and larger scales (regional to global) using modelling (empirical, semi-empirical and process-based biogeochemical models) and remote sensing approaches.

Employment:

2014–2016 Senior scientist/Lecturer, Department of Environmental Systems Science, ETH Zurich

2010-2014 Postdoctoral researcher/Lecturer, Department of Environmental Systems Science, ETH Zurich

2006-2009 Research Assistant and PhD candidate, Max-Planck Institute for Biogeochemistry

Education:

2009, Doctor of Science, ETH Zurich, Switzerland

2006, Diploma in biology equivalent to MSc (ecology, tropical botany and environmental law), Friedrich-Schiller University of Jena, Germany

Selected Recent Peer-reviewed publications:

- Merbold L, Eugster W, Stieger J, Zahniser M, Nelson D and Buchmann N: Greenhouse gas budget (CO₂, CH₄ and N₂O) of intensively managed grassland following restoration (2013) *Global Change Biology* 20, 1918-1928.
- Valentini R, Arneth A, Bombelli A, Castaldi S, Cazzolla Gatti R, Chevallier F, Ciais P, Grieco E, Hartmann J, Henry M, Houghton RA, Jung M, Kutsch WL, Malhi Y, Mayorga E, **Merbold L**, Murray-Tortarolo G, Papale D, Peylin P, Poulter B, Raymond PA, Santini M, Sitch S, Vaglio Laurin G, van der Werf GR, Williams CA, Scholes RJ : The full greenhouse gases budget of Africa: synthesis, uncertainties and vulnerabilities (2014) *Biogeosciences* 11, 381-407 doi:10.5194/bg-11-381-2014
- Merbold L, Ardoe J, Arneth A, Scholes RJ, Nouvellon Y, de Grandcourt A, Archibald S, Bonnefond JM, Boulain N, Brueggemann N, Bruemmer C, Cappelaere B, Ceschia E, El-Khidir HAM, El-Tahir BA, Falk U, Kergoat L, Lloyd J, Le Dantec V, Mougou E, Muchinda M, Mukelabai MM, Ramier D, Rouspard O, Timouk F and Kutsch WL: Precipitation as driver of carbon fluxes in 11 African ecosystems (2009) *Biogeosciences* 6, 1027-1041 doi:10.5194/bg-6-1027-2009
- Eugster W and Merbold L (2015) Eddy Covariance For Quantifying Trace Gas Fluxes From Soils. *SOIL* 1, 187-205 doi:10.5194/soil-1-187-2015
- Wolf B, Merbold L, Decock C, Tuzson B, Harris E, Six J, Emmenegger L, Mohn J (2015) First on-line isotopic characterization of N₂O emitted from intensively managed grassland. *Biogeosciences* 12: 2517-2531 doi:10.5194/bg-12-2517-2015

Other Evidence of Leadership, large-program management and delivery:

Coordinator: ICOS-CH - Swiss contribution to ICOS (Integrated Carbon Observation System), 4.500.000 CHF, 2013-2017. National PI: Models4Pastures - Robust models for assessing the effectiveness of technologies and managements to reduce N₂O emissions from grazed pastures, 197.000 CHF, 2014 – 2017. Coordinator: COST Action ES0804 ABBA - Advancing the integrated monitoring of trace gas exchange Between Biosphere and Atmosphere, 264.000 Euro, 2011-2013. Chair: ICOS (Integrated Carbon Observation System) Ecosystem Monitoring Station Assembly, 2014-2016

Role in Livestock CRP: Livestock and the Environment Flagship, cluster 2 activity leader on GHG emissions.

Name: An NOTENBAERT

Current position and affiliation: Crop-Livestock Systems Specialist, International Center for Tropical Agriculture (CIAT)

Profile:

Notenbaert is trained as an agricultural engineer with a specialisation in land use planning. She has over 20 years of R&D experience in Africa with a special emphasis on research and development in the framework of multidisciplinary teams, spatial modelling and targeting of pro-poor development.

Employment:

2014-date Senior Scientist – Tropical Forages Program Africa, International Centre for Tropical Agriculture (CIAT), Nairobi, Kenya

2006-2013 Scientist – Livestock Systems and the Environment, International Livestock Research Institute, Nairobi, Kenya

2003-2005: GIS Consultant - International Livestock Research Institute, Strategic Analysis and Knowledge Support System, World Agro-Forestry Centre, Government of Kenya

1998-2002: Project Manager PolyGIS, Kenya Polytechnic – Flemish Association for Training Programs Overseas

Education:

1989-1994: Bio-engineer in Land and Forest Management, Catholic University Leuven, Belgium

Selected Recent Peer-reviewed publications:

- Searchinger, T., Estes, L., Thornton, P.K., Beringer, T., Notenbaert, A., Rubenstein, D., Heimlich, R., Licker, R. and Herrero, M. 2015. High carbon and biodiversity costs from converting Africa's wet savannahs to cropland. *Nature Climate Change* 5: 481–486.
<http://dx.doi.org/10.1038/nclimate2584>
- Notenbaert, A., Lannerstad, M., Herrero, M., Fraval, S., Ran, Y., Paul, B., Mugatha, S., Barron, J. and Morris, J. 2014. A framework for environmental ex-ante impact assessment of livestock value chains. Presented at the 6th All Africa Conference on Animal Agriculture, Nairobi, Kenya, 26-30 October 2014.
- Blümmel, M., Haileslassie, A., Samireddypalle, A., Vadez, V. and Notenbaert, A. 2014. Livestock water productivity: Feed resourcing, feeding and coupled feed-water resource data bases. *Animal Production Science* 54: 1584–1593
- Herrero M., Havlík, P., Rufino, M., Notenbaert, A., Thornton, P., Kruska, R., Blummel, M. and Obersteiner M. 2013. Global livestock: Biomass use, production, excretions and greenhouse gas emissions. *PNAS* 110: 20888-20893.
- Notenbaert A., Davies J., Leeuw, J. de, Said, M., Herrero, M., Manzano, P., Waithaka, M., Aboud, A. and Omondi, S. 2012. Policies in support of pastoralism and biodiversity in the heterogeneous drylands of East Africa. *Pastoralism: research, policy and practice* 2: 14.

Other Evidence of Leadership, large-program management and delivery:

Notenbaert is a senior scientist at the Tropical Forages program of CIAT, where she coordinates the program's activities in Africa, including several multi-partner R4D projects. She actively contributed to the Livestock and Fish CRP, both in the capacity of theme/Flagship leader and as a contributor to several science outputs related to targeting, environmental impact assessment and systems analysis.

Role in Livestock CRP: Principal Investigator coordinating Cluster 1 in Livestock and the Environment Flagship; Livestock Feeds and Forages Flagship, clusters 2 and 4.

Name: Rolf SOMMER

Current position and affiliation: Senior Scientist, International Center for Tropical Agriculture (CIAT)

Profile: Sommer has over 15 years of experience in R&D in tropical, subtropical and temperate regions. His research comprises soil resources and climate change, sustaining soil fertility and health at various scales. Addressing soil fertility and conservation in the context of land use dynamics and climate change has been part of his day-to-day work for the last decade.

Employment:

2012, Visiting Scientist, Biological Systems Engineering Department, Washington State University, USA
2009–2012, Senior Scientist, International Center for Agricultural Research in the Dry Areas, ICARDA

Education:

2000, PhD in Agronomy, Institute of Agriculture in the Tropics at Georg-August-University of Göttingen, Germany.

1996, MSc in Biology, University of Göttingen.

Selected Recent Peer-reviewed publications:

- Djanibekov, N., and R. Sommer 2014. Integrated Decision Support for Sustainable and Profitable Land Management in the Lowlands of Central Asia, In: Mueller, L., Saparov, S., Lischeid, G (Eds.), *Novel Measurement and Assessment Tools for Monitoring and Management of Land and Water Resources in Agricultural Landscapes of Central Asia*. Springer Cham Heidelberg New York Dordrecht London, pp. 407-422.

- Sommer, R. and D. Bossio 2014. Dynamics and climate change mitigation potential of soil organic carbon sequestration. *Journal of Environmental Management* 144, 83-87.
- Sommer, R., Mukalama, J., Kihara, J., Koala, S., Winowiecki, L. and D. Bossio 2015. Nitrogen dynamics and nitrous oxide emissions in a long-term trial on integrated soil fertility management in Western Kenya. *Nutr. Cycl. Agroecosyst.* DOI 10.1007/s10705-015-9693-6
- Sommer, R., Thierfelder, C., Tittonell, P., Hove, L., Mureithi, J. and S. Mkomwa 2014. Fertilizer use should not be a fourth principle to define conservation agriculture. *Field Crops Research* doi: 10.1016/j.fcr.2014.05.012
- Bobojonov, I., Aw-Hassan, A. and R. Sommer 2013. Index-based insurance for climate risk management and rural development in Syria. *Climate and Development* <http://dx.doi.org/10.1080/17565529.2013.844676>
- Ryan, J., Rashid, A., Torrent, J., Yau, S.K., Ibrikci, H., Sommer, R. and E.B. Erenoglu 2013. Micronutrient Constraints to Crop Production in the Middle East–West Asia Region: Significance, Research, and Management. *Advances in Agronomy* 122, 1-84.
- Sommer, R., Glazirina, M., Yuldashev, T., Otarov, A., Ibraeva, M., Martynova, L., Bekenov, M., Kholov, B., Ibragimov, N., Kobilov, R., Karaev, S., Sultonov, M., Khasanova, F., Esanbekov, M., Mavlyanov, D., Isaev, S., Abdurahimov, S., Ikramov, R., Shezdyukova, L. and E. de Pauw 2013. Impact of climate change on wheat productivity in Central Asia. *Agriculture Ecosystems and Environment* 178, 78–99.

Other Evidence of Leadership, large-program management and delivery: Over the past seven years, Sommer has contributed to R4D through some dozens of international projects with national and international partners; in recent years under CCAFS as well as WLE. He is currently leading CIAT's research project on "Climate-smart soil protection and rehabilitation in Benin, Burkina Faso, Ethiopia, India and Kenya" funded by GIZ/BMZ Germany. His position with CIAT includes the supervision of CIAT's Soil Laboratory in Nairobi and its three research assistants.

Role in Livestock CRP: Provide expertise on soil fertility, the assessment of potentials of climate change mitigation as well as assessing systems dynamics through biophysical modelling.

Name: Lance ROBINSON

Current position and affiliation: Governance and Resilience Scientist, International Livestock Research Institute (ILRI)

Profile: Robinson brings 20 years of NGO and academic experience to bear on the research to development continuum. His areas of expertise include environmental governance, pastoralist development and social-ecological resilience.

Employment:

2012-2013, Post-doctoral scientist; International Livestock Research Institute; Kenya

2012, Consultancy-Institutional/stakeholder participation specialist; SMEC; Tanzania

2009-2012, Post-doctoral fellow; Vancouver Island University; Canada

Education:

2009, PhD in Natural Resources and Environmental Management, University of Manitoba, Canada

1994, MSc in International Rural Development Planning, University of Guelph, Canada

Selected Recent Peer-reviewed Publications:

- Robinson, L.W., Ericksen, P.J., Chesterman, S. and Worden, J.S. 2015. Sustainable intensification in drylands: What resilience and vulnerability can tell us. *Agricultural Systems* 135:133-140
- Robinson, L.W. and Makupa, E. 2015. Using Analysis of Governance to Unpack Community-Based Conservation: A Case Study from Tanzania. *Environmental Management*.

- Davies, J., Robinson, L.W. and Ericksen, P.J. 2015. Development Process Resilience and Sustainable Development: Insights from the Drylands of Eastern Africa. *Society and Natural Resources*. 28(3): 328-343.
- Robinson, L.W., and Sasu, K.A. 2012. The Role of Values in a Community-Based Conservation Initiative in Northern-Ghana. *Environmental Values* 22: 647–664.
- Robinson, L.W. and Berkes, F. 2011. Multi-level Participation for Building Adaptive Capacity: Formal Agency-Community Interactions in Northern Kenya. *Global Environmental Change* 21(4): 1185-1194.
- Robinson, L.W. and Fuller, A.M. 2010. Towards an Ecosystem Approach to Policy Process: Insights from the Sustainable Livelihoods and Ecosystem Health Approaches. *International Journal of Sustainable Development* 13(4): 393-411.
- Robinson, L.W. and Berkes, F. 2010. Applying Resilience Thinking to Questions of Policy for Pastoralist Systems: Lessons from the Gabra of Northern Kenya. *Human Ecology* 38: 335-350.

Other Evidence of Leadership, large-program management and delivery: Leading rangelands components of USAID Feed the Future funded project *Accelerated Value Chain Development – Livestock Component*. Activities in five counties in Kenya; Co-leading IFAD-funded project *Enhancing the Value of Ecosystem Service in Pastoral Systems*. Activities in Kenya and Burkina Faso; Co-leading USAID-funded project *Local Governance and Adaptation to Climate Change*. Activities in Burkina Faso and Kenya; Have led or co-led various other CRP-funded projects and activities in Kenya, Senegal and Ethiopia.

Role in Livestock CRP: Livestock and the Environment Flagship, cluster 3 leader.

Name: Björn VINNERÅS

Current position and affiliation: Associate Professor of Environmental Engineering, Department of Energy and Technology, Swedish University of Agriculture (SLU)

Profile: Vinnerås has 17 years of experience working on productive waste (organic waste, animal and human manure) and wastewater management issues, including both participating in and leading multi-partner projects. He previously worked as researcher at the National Veterinary Institute and at the Swedish University of Agricultural Sciences. He was responsible for the development of the hygiene part of the single use, biodegradable, self-sanitising toilet Peepoo and is project leader in Sprout, an EU-project within the Eco-Innova program.

Employment:

2009–2013, Assistant Professor, Department of Energy and Technology, SLU and Department of Disease Control and Biosecurity, Swedish Veterinary Institute.

2005–2008, Associate Professor Environmental Engineering, Swedish University of Agricultural Sciences (SLU)

Education:

2002, PhD in Technology, Swedish University of Agricultural Sciences, Sweden.

Selected Recent Peer-reviewed publications: 70 peer reviewed publications, H-value 15.

- Fidjeland, J., Nordin, A., Pecson, B.M., Nelson, K. L., Vinnerås, B. 2015. Modelling the inactivation of ascaris eggs as a function of ammonia concentration and temperature. *Water Research*, 83 pp 153-160.
- Kinobe, J. R., Bosona, T., Gebresenbet, G., Niwagaba, C. B., Vinnerås, B. 2015. Optimization of waste collection and disposal in Kampala city. *Habitat international* 49: 126-137.
- Lalander, C., Komakech, A., Vinnerås, B. 2015. Vermicomposting as manure management strategy for urban small-holder animal farms – Kampala case study. *Waste Management*

- Magri, M., Fidjeland, J., Jönsson, H., Albiñ, A., Vinnerås, B. 2015. Inactivation of Adenovirus, Reovirus and Bacteriophages in Faecal Sludge by pH and Ammonia. *Science of the Total Environment* 520: 213-221.
- Nyberg, K., Ottoson J., Vinnerås, B., Albiñ, A. 2014. Fate and survival of Salmonella Typhimurium and Escherichia coli O157:H7 in repacked soil lysimeters after application of cattle slurry and human urine. *Journal of the Science of Food and Agriculture* 94(12): 2541-2546.
- Komakech, A., Banadda, E.N., Gebresenbet, G., Vinnerås, B., 2014. Maps of animal urban agriculture in Kampala. *Agronomy for Sustainable Development* 34(2): 340-348.

Other Evidence of Leadership, large-program management and delivery: Coordinator of the EU-Program Sprout with Swedish and Swiss collaboration partners. One of the developers of the biodegradable, single use, self-sanitizing toilet Peepoo, implemented in Kibera area in Nairobi, Kenya.

Role in Livestock CRP: SLU representative in the Livestock and the Environment Flagship, with expertise in wastewater and waste, including manure, management for safe reuse in productive agriculture.

Livestock, Livelihoods and Agri-Food Systems Flagship – Key scientists (10)

Name: Isabelle BALTENWECK

Current position and affiliation: Program leader, livelihoods, gender and impact program, International Livestock Research Institute (ILRI)

Profile: An agricultural economist, she has fifteen years of post-doctoral experience in various aspects of smallholder livestock farming in Africa, South and South-East Asia, working on innovative institutional mechanisms to enhance farm level competitiveness in inclusive value chain development initiatives. Most of her work has a strong focus on gender. In the current Livestock and Fish program, she coordinates activities on nutrition and value chain upgrading.

Employment:

2004-2013, Scientist, International Livestock Research Institute, Nairobi

2000-2013, Post-doctoral scientist, Market-Oriented smallholder dairy project, International Livestock Research Institute, Nairobi

Education:

2000, PhD in Development Economics, Université d'Auvergne, France

1996, MSc in Development Economics, Université d'Auvergne, France

Selected Recent Peer-reviewed publications:

- Njuki, J., Wyatt, A., Baltenweck, I., Yount, K., Null, C., Ramakrishnan, U., Webb Girard, A., and Sreenath, S. 2015. An exploratory study of dairying intensification, women's decision making, and time use and implications for child nutrition in Kenya. *European Journal of Development Research*
- Kristjanson, P., Waters-Bayer, A., Johnson, N., Tipilda, A., Njuki, J., Baltenweck, I., Grace, D., MacMillan, S. 2014. Livestock and Women's Livelihoods: A Review of the Recent Evidence. IN: Quisumbing, A.R. et al. 2014. Gender in agriculture: Closing the knowledge gap. Dordrecht: Springer.
- Herrero, M., Thornton, P.K., Bernue, A., Baltenweck, I., Vervoort, J. Steeg, J. van de., Makokha, T., Wijk, M.T. van., Karanja, S., Rufino, M.C., Staal, S.J. 2014. Exploring future changes in smallholder farming systems by linking socio-economic scenarios with regional and household models. *Global Environmental Change* 24: 165–182.
- Anjani K., Staal, S.J., Baltenweck, I. and Lapar, L.L. 2014. Traditional milk markets in Assam: potential for income and employment generation. *Indian Journal of Agricultural Economics* 65: 747-759.
- Njuki, J., Poole, J., Johnson, N., Baltenweck, I., Pali, P., Lokman, Z. and Mburu, S. 2011. Gender, livestock and livelihood indicators. Nairobi, Kenya: ILRI. <http://hdl.handle.net/10568/33974>
- Steeg, J.A van de., Verburg, P.H., Baltenweck, I., Staal, S.J. 2010. Characterization of the spatial distribution of farming systems in the Kenyan Highlands. *Applied Geography* 30: 239–253.
- Kijima, Y., Yamano, T. and I. Baltenweck. 2010. Emerging markets in the post-liberalisation period: Evidence from the raw milk market in rural Kenya. *Journal of African Economies* 19: 88-110.
- Baltenweck, I. and Staal, S.J. 2007. Beyond one-size-fits-all: differentiating market access measures for commodity systems in the Kenyan highlands. *Journal of Agricultural Economics* 58: 536-548.

Other Evidence of Leadership, large-program management and delivery: Leads a research program at ILRI coordinates the ILRI inputs into the East Africa Dairy Development program, providing evidence-based support to this consortium led by Heifer International.

Role in Livestock CRP: Livestock Livelihoods and Agri-Food Systems Flagship, leads cluster 5.

Name: Stefan BURKART

Current position and affiliation: Socio-economist/Program Officer, Tropical Forages Program, International Centre for Tropical Agriculture (CIAT)

Profile: Burkart's major focus lies on value chain assessment, business model development, economic analyses of agricultural technologies, knowledge and innovation systems and social network analysis. He joined CIAT's Tropical Forages Program in 2014 after working at University of Hohenheim for 2 years in social sciences. He is CIAT's representative in the Colombian Roundtable for Sustainable Cattle Production and leads the working groups on markets and productivity.

Employment:

2012 – 2014, Socio-economist Post Doc, University of Hohenheim, Stuttgart, Germany

2009 – 2012, Research Associate/PhD Student, University of Hohenheim, Stuttgart, Germany

Education:

2012, PhD in Socio-economics, University of Hohenheim, Stuttgart, Germany

2009, MS in. Agribusiness, University of Hohenheim, Stuttgart, Germany

Selected Recent Peer-reviewed publications:

- Sadegh Salehi, Zahra Pazuki Nejad, Hossein Mahmoudi and Stefan Burkart (2016, in press): Knowledge of Global Climate Change: View of Iranian University Students. International Research in Geographical and Environmental Education.
- Burkart, S. 2012. Improving business models of smallholder pig and poultry producers in Colombia and Nicaragua - Potentials of sustainable value chain development. Weikersheim, Germany: Margraf Publishers.

Other Evidence of Leadership, large-program management and delivery: Coordination of the socio-economic research group at CIAT's Tropical Forages Program. Leader of 2 working groups (markets, productivity) of the Colombian Roundtable for Sustainable Cattle Production.

Role in Livestock CRP: Livestock Livelihoods and Agri-Food Systems Flagship, cluster 5

Name: Paula DOMINGUEZ-SALAS

Current position and affiliation: Postdoctoral researcher; joint position between the Royal Veterinary College, UK, and International Livestock Research Institute (ILRI); core member of the Leverhulme Centre of Integrative research in Agriculture and Health.

Profile: Dominguez-Salas is specialised in international public health and nutrition and is also a trained veterinarian and a food technologist. She has experience in development and emergency settings in Africa (West and East) and Latin America (both in research and operations), particularly in maternal and child nutrition. She has worked for a variety of stakeholders, from government and academia, to international NGOs and international institutions, in English, French, Spanish and Portuguese-speaking countries. Now her focus is in the integration of nutrition in agriculture research and interventions

Employment:

2013-16, Postdoctoral researcher. Royal Veterinary College, London, UK/International Livestock Research Institute, Nairobi, Kenya.

2009-13, Research fellow. London School of Hygiene and Tropical Medicine, London, UK

2008, Nutrition Coordinator, Medicos del Mundo, Madrid, Spain

Education:

2013, PhD in Public Health Nutrition, London School of Hygiene and Tropical Medicine, UK

2007, MSc in International Public Health Nutrition, London School of Hygiene and Tropical Medicine, UK

Selected Recent Peer-reviewed publications:

- Picchioni F, Aleksandrowicz A, Bruce MM, Cuevas S, Dominguez-Salas P et al. 2016. Agri-health research: what have we learned and where to next? *Food Sec* 12/2015; doi: 10.1007/s12571-015-0540-z.
- Silver, M.J., Corbin, K.D., Hellenenthal, G., da Costa, K.A., Dominguez-Salas, P. *et al.* 2015. Evidence for Negative Selection at SNPs Increasing Dietary Choline Requirement in a Gambian Cohort. *FASEB Journal* 29(8):3426-35
- Hernandez-Vargas, H., Castelino, J., Silver, M.J., Dominguez-Salas, P. *et al.* 2015. Exposure to aflatoxin B1 in utero is associated with DNA methylation in white blood cells of infants in The Gambia. *International Journal of Epidemiology*
- Dominguez-Salas, P. *et al.* 2014. Maternal Nutrition at Conception Modulates DNA Methylation of Human Metastable Epialleles. *Nature Communications* 29: 3746.
- Castelino, J.M., Dominguez-Salas, P. *et al.* 2014. Seasonal and gestation-stage associated differences in dietary aflatoxin exposure in pregnant Gambian women. *Tropical Medicine and International Health* 9: 348-54.
- Dominguez-Salas, P. *et al.* 2013. DNA methylation potential: dietary intake and blood concentrations of one-carbon metabolites and cofactors in rural African women. *American Journal of Clinical Nutrition* 97:1217-1227.
- Dominguez-Salas, P. *et al.* 2012. Maternal nutritional status, one-carbon metabolism and offspring DNA methylation: A review of current evidence in humans. *Proceedings of the Nutrition Society* 71: 154-65.

Role in Livestock CRP: Nutrition expert, Livestock Livelihoods and Agri-Food Systems Flagship, cluster 3.

Name: Dolapo ENAHORO

Current position and affiliation: Agricultural Economist, International Livestock Research Institute

Profile: Applied economics researcher with interests in international development, agricultural trade and policy, and the environment. More than five years of experience building and applying tools of quantitative foresight analysis to the global livestock sector and to developing country contexts. Current research is on the evaluation of technology, investment and policy options for improving livestock productivity and the impacts on socioeconomic outcomes and the environment.

Employment:

2008 – 2010, Graduate Research Assistant, Cornell University

Education:

2010. PhD in Regional Science, Cornell University

2006, MS in Applied Economics and Management, Cornell University

Selected Recent Peer-reviewed publications:

- Baker, D., and Enahoro, D. 2014. Policy analysis and advocacy for livestock based development: The gap between household-level analysis and higher level models. *Food Policy* 49: 361-364.
- Msangi, S., D. Enahoro, M. Herrero, N. Magnan, P. Havlik, A. Notenbaert and S. Nelgen. 2014. Integrating livestock feeds and production systems into agricultural multi-market models: the example of IMPACT. *Food Policy* 49: 365-377.
- van Wijk, M.T., Rufino, M.C., Enahoro, D., Parsons, D., Silvestri, ., Valdivia, R.O. and Herrero, M. 2014. Farm household modelling to analyze food security in a changing climate: a review. *Global Food Security* 3: 77 -84.

- McDermott, J., D. Enahoro, and M. Herrero. 2013. Livestock futures to 2020 - implications for food, environmental, health and global security. IN: Barrett, C.B. 2013. Food Security and Sociopolitical Stability. Oxford UK: Oxford University Press: 221-228.
- Herrero, M., D. Grace, J. Njuki, N. Johnson, D. Enahoro, S. Silvestri and M.C. Rufino. 2013. The roles of livestock in developing countries. *Animal* 7: 3–18.
- Schmit, T.M., Boisvert, R., Enahoro, D. and Chase, L. 2009. Optimal dairy farm adjustments to increased utilization of corn distillers dried grains with solubles. *Journal of Dairy Science* 92: 6105-6115.

Other Evidence of Leadership, large-program management and delivery: Principal researcher for the Global Futures and Strategic Foresight (GFSF) project; Co-organized International conference on Livestock Policy Analysis and Advocacy, November 2013.

Role in Livestock CRP: Livestock Livelihoods and Agri-Food Systems Flagship cluster 1.

Name: Shinan KASSAM

Current position and affiliation: Social Scientist (Agricultural Economics, Development Economics), International Center for Agricultural Research in Dry Areas (ICARDA)

Profile: Kassam's research is aimed at better understanding rural livelihood systems in water short environments; and through participatory research and learning, uncovering avenues for enhancing the process of agricultural innovation for development within supportive (social, economic, policy) enabling environments. He pays specific attention to the contextually constructed roles for men, women, youth and children in agricultural production and marketing, how these roles affect production and consumption decisions, and the impact that inequity in access to resources has on household well-being and quality of life within rural communities in dry environments.

Employment:

2013 – 2014 Consultant, ICARDA

2008 – 2012 Senior Technical Advisor, Aga Khan Foundation, Syria

2006 – 2008 Chief Executive Officer, Aga Khan Foundation, Kyrgyz Republic

Education:

2011, PhD in Resource Management and Environmental Studies, University of British Columbia

1991, MSc in Agricultural Economics, University of British Columbia

Selected Recent Peer-reviewed publications:

- Kassam, S.N. and Lamprinakos, L. in press. Targeted Regional Innovation Systems, Cooperatives and Socio-economic Development. *Journal of Rural Studies*.
- Thabet, B., Dhehibi, B., Kassam, S., Aw-Hassan, A. 2015. Good Intentions and Hard Realities: Achievements and Challenges in the Agricultural Extension System in Tunisia. *International Journal of Agricultural Extension* 3(3): 209-215.
- Aktas, A.H., B. Gok, S. Ates, M.E. Tekin, I. Halici, H. Bas, H. Erduran, and S. Kassam. 2015. Fattening performance and carcass characteristics of Turkish indigenous Hair and Honamlı goat male kids. *Turkish Journal of Veterinary and Animal Science* (doi: 10.3906/vet-1505-84)
- Malhotra, N., Rus, H. and Kassam, S. 2008. Antidumping duties in the agricultural sector: Trade restricting or trade deflecting? *Global Economy Journal* (doi: 10.2202/1524-5861.1299)

Other Evidence of Leadership, large-program management and delivery: Project Coordinator: "Integrated Agricultural Production Systems for the Poor and Vulnerable in Dryland Areas" with a budget of \$1,400,000. Senior Technical Advisor: "Enhancing quality of life and rural livelihoods in Salamieh district" with a budget of \$1,500,000. Chief Executive Officer – Aga Khan Foundation (Kyrgyz

Republic). Executive, managerial and technical oversight of an integrated rural support program (rural development, community based public health, early childhood development).

Role in Livestock CRP: Livestock Livelihoods and AgriFood Systems Flagship, cluster 5.

Name: Girma KASSIE

Current position and affiliation: Senior Agricultural Market Economist, Social, Economic, and Policy Research Program, International Center for Agricultural Research in Dry Areas (ICARDA)

Profile: Kassie has close to 20 years of research and teaching experience in the fields of agricultural production economics, agricultural marketing and value chain analysis, discrete choice analysis, agricultural risk analysis, and monitoring, evaluation and impact assessment of agricultural programs and technologies. He has been part of the Livestock and Fish CRP since January 2014 leading the socio-economics component of the small ruminant value chain research activities in Ethiopia.

Employment

2009-2013, Associate Scientist, CIMMYT

Education

2008, PhD World Food Economics, University of Kiel, Germany

2002, MSc Agricultural Economics, Haramaya University, Ethiopia

Selected Recent Peer-reviewed Publications

- Bezu S, Kassie G T, Shiferaw B, and Ricker-Gilbert J. 2014. Impact of Improved Maize Adoption on Welfare of Farm Households in Malawi: A Panel Data Analysis. *World Development*, 59: 120–131.
- Kassie, G. T., Abate, T., Langyintuo, A. and Maleni, D. 2014. Poverty in maize growing rural communities of southern Africa. *Development Studies Research*: 1: 311-323/ <http://dx.doi.org/10.1080/21665095.2014.969844>
- Smale, M., Simpungwe, E., Birol, E., Kassie, G. T., De Groote, H. and Mutale, R. 2014. The Changing Structure of the Maize Seed Industry in Zambia: Prospects for Orange Maize. *Agribusiness* 31(1): 132-146. <http://dx.doi.org/10.1002/agr.21384>.
- Thierfelder, C., Rusinamhodzi, L., Ngwira, A.R. Mupangwa, W., Nyagumbo, I., Kassie G. T. and Cairns, J.E. 2014. Conservation agriculture in Southern Africa: Advances in knowledge. *Renewable Agriculture and Food Systems*. 30: 328-348. <http://dx.doi.org/10.1017/S1742170513000550>.
- Kassie, G.T., Erenstein, O., Mwangi, W., MacRobert, F., Setimela, P. and Shiferaw, B. 2013. Political and Economic Features of the Maize Seed Industry in Southern Africa. *Agrekon* 52: 104-127.
- Homann Kee-Tui, S., Blümmel, M., Valbuena, D., Chirima, A., Masikati, P., Rooyen, A.F. van, and Kassie G T. 2013. Assessing the potential of dual-purpose maize in southern Africa: A multi-level approach. *Field Crops Research*, 153: 37–51.
- Terfa, Z.G., Haile, A., Baker, D. and Kassie G T. 2013. Valuation of traits of indigenous sheep using hedonic method in Central Ethiopia. *Agricultural and Food Economics* 1: 6.
- Katengeza, S.P., Mangisoni, J.H., Kassie, G.T., Sutcliffe, C., Langyintuo, A., La Rovere, R., and Mwangi, W. 2012. Drivers of Adoption of Improved Maize Varieties in Drought Prone Areas of Malawi. *Journal of Development and Agricultural Economics* 4: 393-403.

Other Evidence of Leadership, large-program management and delivery: Leader, marketing and value chain research at ICARDA; ICARDA focal person, Efficient and Inclusive Value Chain Flagship for PIM CRP; Led socioeconomic research activities of the drought tolerant maize for Africa (DTMA) project in southern Africa (while at CIMMYT); Led socioeconomic research program at Amhara regional agricultural research institute (ARARI)

Role in Livestock CRP: Livestock Livelihoods and Agri-Food Systems Flagship, clusters 3 and 5.

Name: Emily OUMA

Current position and affiliation: Scientist – Agricultural Economist, International Livestock Research Institute (ILRI)

Profile: An agricultural economist, Ouma has 7 years of post-doctoral experience in economic analysis of smallholder agricultural systems and value chains in sub-Saharan Africa. Her research focus areas are on smallholder farm level competitiveness as well as value chain development and analysis. She has been coordinating the Uganda pig value chain R4D work as well as leading the socio-economic research components in the current Livestock and Fish program.

Employment:

2008-2012, Post-doctoral scientist, IITA

Education:

2007, PhD in Agricultural Economics, University of Kiel, Germany

2003, MSc in Agricultural Economics, Egerton University, Kenya

Selected Recent Peer-reviewed publications:

- Ouma, E., Dione, M., Lule, P., Roesel, K. and Pezo, D. 2014. Characterization of smallholder pig production systems in Uganda: Constraints and opportunities for engaging with market systems. *Livestock Research for Rural Development* 26(3): Article #56
- Ouma, E., Macharia, I., Birachi, E., Garming, H., Nyagaya, M., Pypers, P., Ochieng, J., Blomme, G., Asten, P. van and Vanlauwe, B. 2013. Agricultural technology diffusion and adoption in banana and legume based systems of Central Africa. IN: Vanlauwe, B., Asten, P. van and Blomme, G. 2013. Agro-ecological intensification of agricultural systems in the African highlands. London: Routledge.
- Vanlauwe, B., Pypers, P., Birachi, E.A., Nyagaya, M., Van Schagen, B., Huising, J., Ouma, E., Blomme, G.; Van Asten, P. 2012. Integrated soil fertility management in Central Africa: experiences of the consortium for improving agriculture based livelihoods in Central Africa (CIALCA). IN: Hershey, C.H. and Neate, P. 2012. Tropical Agriculture Eco-Efficiency: From Vision to Reality. Cali: CIAT.
- Ouma, E., Birachi, E. and Pypers, P. 2012. Households livelihood status in agro-base systems of Central Africa: CIALCA livelihoods baseline. Hamburg, Germany: Lambert Academic Publishing.
- Ouma, E., Jagwe, J., Obare, G. and Abele, S. 2010. Determinants of smallholder farmers' participation in banana markets in Central Africa: The role of transaction costs. *Agricultural Economics* 41: 111-122.
- Ouma, E., Abdulai, A. and Drucker, A. 2007. Measuring heterogeneous preferences for cattle traits amongst cattle keeping households in East Africa. *American Journal of Agricultural Economics* 89(4): 1005 – 1019.

Other Evidence of Leadership, large-program management and delivery: Leads the Uganda pig value chain R4D program since 2015 under the CGIAR Research Program on Livestock and Fish. Coordinates an Irish Aid funded R4D pig value chain project entitled “More pork by and for the poor: Catalysing emerging smallholder pig value chains in Uganda for Food Security and Poverty Reduction”

Role in Livestock CRP: Livestock Livelihoods and Agri-Food Systems Flagship; cluster 5.

Name: Barbara RISCHKOWSKY

Current position and affiliation: Director, Sustainable Intensification and Resilience of Production Systems Program, International Center for Agricultural Research in Dry Areas (ICARDA)

Profile: Rischkowsky has 25 years of experience in production systems analysis and the development of technological and institutional interventions for increasing livestock productivity in resource-poor

ruminant production systems. She has a profound experience in acquisition, coordination and management of multi-disciplinary and multi-national projects in Africa, Asia and Latin America. Prior to joining ICARDA as Senior Livestock Scientist, she coordinated the compilation of the first State of the World's Animal Genetic Resources for Food and Agriculture at FAO and worked as an Assistant Professor and senior scientist at the Georg-August University in Goettingen and the Justus-Liebig University in Giessen, focusing on the analysis of livestock production systems in the tropics and subtropics and the development of productivity indicators. Since November 2006, Rischkowsky has led the small ruminant research group at ICARDA. She has authored or co-authored over 190 scientific publications.

Employment:

2006 - 2015: Principal Livestock scientist, ICARDA, Syria

2005 - 2006: Professional Officer, FAO, Italy

2001 - 2003: Senior research scientist and lecturer, Justus-Liebig-University, Germany

1994 - 2001: Research scientist and lecturer, Georg-August-University, Germany

Education:

1996, Doctor in Agricultural Sciences, Justus-Liebig-University, Giessen, Germany.

1989, Master of Science in Agricultural Sciences, Justus-Liebig-University, Giessen, Germany.

Selected Recent Peer-reviewed publications:

- Mueller, J.P., Rischkowsky, B., Haile, A., Philipsson, J., Mwai, A.O., Besbes, B., Valle Zárate, A., Tibbo, M., Mirkena, T., Duguma, G., Sölkner, J., Wurzinger, M. 2015. Community based livestock breeding programs: essentials and examples. *Journal of Animal Breeding and Genetics* 132: 155–168.
- Dubeuf, J.-P., Bendapudi, R., Bhandari, D., Capote, J., Carrasco-Sanchez, R., Daskiran, I., Guimaraes, V., Iniguez, L., Koluman-Darcan, N., Peacock, C., Rota, A., Rischkowsky, B., Sepe, L. 2014. Scaling up successful practices for pro-poor development projects involving goats: First outputs of a comparative study. *Small Ruminant Research* 121: 146–156.
- Siegmund-Schultze, M., Rischkowsky, B., Yuldashev, I., Abdalniyazov, B., Lamers, J.P.A. 2013. The emerging small-scale cattle farming sector in Uzbekistan: Highly integrated with crop production but suffering from low productivity. *Journal of Arid Environments* 98: 93-104.
- Hilali, M., Iñiguez, L., Knaus, W., Schreiner, M., Rischkowsky, B., Wurzinger, M., Mayer, H.K. 2011. Prospects for using nonconventional feeds in diets for Awassi dairy sheep in Syria. *Journal of Dairy Science* 94: 3014–3024.
- Siegmund-Schultze, M., Rischkowsky, B., da Veiga, J.B., King, J.M. 2010. Valuing cattle on mixed smallholdings in the Eastern Amazon. *Ecological Economics* 69: 857–867
- Homann, S., Rischkowsky, B., Steinbach, J. 2008. The effect of development interventions on the use of indigenous range management strategies in the Borana Lowlands in Ethiopia. *Land Degradation and Development* 19: 368-387.
- FAO. 2007. The State of the World's Animal Genetic Resources for Food and Agriculture, edited by B. Rischkowsky and D. Pilling. Rome: FAO.

Other Evidence of Leadership, large-program management and delivery: Coordination and joint proposal development of IFAD funded project Improving Livelihoods of Small Farmers and Rural Women through Value-Added Processing and Export of Cashmere, Wool and Mohair at ICARDA; Coordinator and Editor of the First State of the World's Animal Genetic Resources at FAO; Coordination of the EU-funded INCO-DC project Development of sustainable pastoral and agro-pastoral livelihood systems in West Africa at Justus-Liebig University; Coordination and proposal development of the BMBF-funded SHIFT (Studies on Human Impact on Forests and Floodplains in the Tropics) project Role of cattle in the fallow systems in the Eastern Amazon, Brazil at Georg-August-University

Role in Livestock CRP: Livestock Livelihoods and Agri-Food Systems Flagship, leads cluster 4; Country coordinator, Ethiopia

Name: Timothy ROBINSON

Current position and affiliation: Principal Scientist, Livestock Systems and Environment, International Livestock Research Institute (ILRI)

Profile: Robinson has more than 20 years of experience working in the field of spatial analysis in relation to agriculture, food security and poverty alleviation, during which he has worked within the United Nations, the CGIAR system, UK universities and government departments. His research includes the application of spatial analytical techniques to understanding current and future livestock species and production systems distributions – particularly in the context of social, environmental and epidemiological risks and opportunities associated with a changing livestock sector.

Employment:

2002-2013, Livestock Information Officer, Livestock Policy Branch, FAO,

1999-2002, Scientist, Targeting and Impact Assessment, ILRI, Kenya

1996-1999, Zoology Research Fellow, Department of Zoology, University of Oxford, UK

1992-1996, Tsetse Ecologist, Natural Resources Institute, Zambia.

Education:

1991, PhD, University of Reading, UK

1988, MA in Pure and Applied Biology, University of Oxford

Selected recent peer-reviewed publications

- Robinson, T.P., Wertheim, H.F.L., Kakkar, M., Kariuki, S., Bu, D. and Price, L.B. 2016. Animal production and antimicrobial resistance in the clinic. *The Lancet* 387 (10014) e1-e3.
- Shaw, A.P.M., Wint, G.R.W., Cecchi, G., Torr, S.J., Mattioli, R.C. and Robinson, T.P. 2015. Mapping the benefit-cost ratios of interventions against bovine trypanosomosis in Eastern Africa. *Preventive Veterinary Medicine* 122, 406–416
- Gilbert, M., Conchedda, G., Van Boeckel, T.P., Cinardi, G., Linard, C., Nicolas, G., Thanapongtharm, W., D'Aiatti, L., Wint, W., Newman, S. and Robinson, T.P. 2015. Mapping the global distribution of intensively farmed chicken and pigs. *PLOS ONE* 10(7): e0133381
- Messina, J.P., Pigott, D.M., Golding, N., Duda, K.A., Brownstein, J.S., Weiss, D.J., Gibson, H., Robinson, T.P., Gilbert, M., Wint, G.R.W., Nuttall, P.A., Gething, P.W., Myers, M.F., George, D.B. and Hay, S.I. 2015) The global distribution of Crimean-Congo hemorrhagic fever. *Transactions of the Royal Society of Tropical Medicine and Hygiene* 109: 1-11.
- Robinson, T.P., Wint, G.R.W., Conchedda, G., Van Boeckel, T.P., Ercoli, V., Palamara, E., Cinardi, G., D'Aiatti, L., Hay, S.I. and Gilbert, M. 2014. Mapping the global distribution of livestock. *PLoS ONE* 9(5): e96084.
- Horby, P., Tatem, A.J., Huang, Z., Gilbert, M., Robinson, T.P., Wint, G.R.W., Hayden, F.G., van Vinh Chau, N., Shindo, N., Carson, G., Gao, Z., Hongjie, Y., Hay, S.I. and Farrar, J. 2013. H7N9 is a virus worth worrying about. *Nature* 496(7446): 399.

Other evidence of leadership, large-program management and delivery: Robinson is the ILRI focal point for the Humidtropics program and has been PI or co-PI on projects with a combined budget of \$22.8 million in the last 5 years.

Role in Livestock CRP: Livestock Livelihoods and Agri-Food Systems Flagship, leads cluster 1.

Name: Mark VAN WIJK

Current position and affiliation Senior Scientist Farming Systems Analysis, International Livestock Research Institute (ILRI)

Profile: Van Wijk has more than 15 years of experience working on both fundamental and applied research in agro-ecosystems across the world. His research focuses on interactions between (agro)ecosystems and the environment and combines empirical and theoretical analyses. This work

was executed in many multi-partner projects. He has previously done household level analyses work for the Livestock and Fish, Climate Change and Food Security and HumidTropics CRPs

Employment:

2003-2011, Assistant Professor Plant Sciences Wageningen University

2001-2003, Post Doc, University of Edinburgh

Education:

2001, PhD in Environmental Sciences, University of Amsterdam, the Netherlands

1996, MSc in Population Biology, Radboud University Nijmegen, the Netherlands

Selected Recent Peer-reviewed publications:

- Frelat, R., Lopez-Ridaura, S., Giller, K.E., Herrero, M., Douchamps, S., Djurfeldt, A., Erenstein, O., Henderson, B., Kassie, M., Paul, B., Rigolot, C., Ritzema, R., Rodriguez, D., van Asten, P., van Wijk, M.T., 2016. Drivers of household food availability in sub-Saharan Africa based on big data from small farms. *PNAS* 113(2): 458–463
- Rurinda, R., van Wijk M.T., Mapfumo P., Descheemaeker K., Supit I., Giller K.E. 2015. Climate change and maize yield in southern Africa: what can farm management do? *Global Change Biology* 21(12): 4588-4601
- van Wijk, M.T. 2014. From global economic modelling to household level analyses of food security and sustainability: how big is the gap and can we bridge it? *Food Policy* 49: 378 - 388.
- van Wijk, M.T., M.C. Rufino, D. Enahoro, D. Parsons, S. Silvestri, R.O. Valdivia, M. Herrero. 2014. Farm household modelling and its role in designing climate-resilient agricultural systems. *Global Food Security* 3: 77-84.
- Klapwijk L, M.T. van Wijk, P. van Asten, P.K. Thornton, K.E. Giller. 2014. Trade-off Analysis in (Tropical) Agricultural Systems. *COSUST* 6: 110 – 115.
- Traore B, M.T. van Wijk; K. Descheemaeker, M. Corbeels, M.C. Rufino, K.E. Giller. 2014. Climate adaptation options for Sudano-Sahelian cropping systems. *Field Crops Research* 156: 63–75.
- Sakané N, M.T. van Wijk, M Langensiepen, M Becker. 2014. Modelling land use decisions by smallholder agrowetland households in rural areas of East Africa. *Agriculture, Ecosystems and Environment* 197: 159–173.

Other Evidence of Leadership, large-program management and delivery: Van Wijk has led household level analyses work for the Livestock and Fish, Climate Change and Food Security and HumidTropics CRPs. At Wageningen University he led the household modelling workpackage within the EU funded AfricaNUANCES program.

Role in Livestock CRP: Contribute to Livestock Livelihoods and Agri-Food Systems Flagship cluster 1.

Annex 3.8 Open access and open data management

Similar to the management of intellectual assets (IA), open access (OA), open data and research data management (RDM) in the CRP are guided by the CGIAR Open Access and Data Management Policy (adopted 2013) and the CGIAR Open Access and Data Management Implementation Guidelines (adopted 2014)³. Open access and research data management actions and platforms are key mechanisms to implement the CGIAR IA principles.

In line with these guidelines, the CRP, through its partners and collaborators, aims to ensure that its research outputs are globally accessible – findable, accessible, inter-operable and re-usable. Together with the legal aspects of IA management and other communication and capacity development interventions, these objectives will enhance innovation, impact, and uptake.

Why open access?

1. Open access is mandated by CGIAR and most funders
2. Open access enables scientific discovery by making knowledge accessible earlier and by encouraging collaboration
3. Open access powers science delivery by empowering development actors to share, re-use and take up knowledge, with few restrictions
4. Open access is possible: it needs proper workflows, platforms, skills, investment and recognition/incentives
5. Open access facilitates inter-operability and exploitation/visualization/application of ‘big data’ and big insights.

Implementing open access

Across the CRP, open access is normally a responsibility of CRP partners. They have their own tools, workflows, legal support, systems and platforms as well as the necessary expertise, institutional buy-in and budget to make it happen. The CRP judiciously exploits and extends the open content they generate by adding value, aggregating and synthesizing across partners and amplifying the results.

Helping partners get to open access is vital to achieving CRP outcomes and recent CGIAR-wide efforts to develop plans in this area are a powerful step towards having a standard approach and platforms. The livestock CRP is committed to this process and will contribute to a more system-wide and consistent approach that will speed the delivery of CRP goals. We will support the inclusion of open-access budgeting and planning in project design, and support activities that help scientists embrace open access practices.

This is a new CRP, so it will work with a different set of platforms and systems. It will build on the open access and data systems put in place by the existing Livestock and Fish CRP (including ILRI, CIAT and ICARDA), but expand to ensure that the outputs of new partners (WUR, SLU, GIZ, ICRAF, IWMI) are handled in line with open access principles and guidelines.

- For information products, the primary platform is CGSpace, used by ILRI, CIAT, IWMI and ICARDA as well as the Livestock and Fish CRP (all of whose outputs are in the database). The new CRP will replicate this approach, discussing with the non-CGSpace partners how their content can become 1) globally accessible and 2) part of the CRP knowledge base (without necessarily being ‘in’ CGSpace).
- For data products, the primary platform is ILRI’s CKAN data portal, with inter-operability (links) to strategic CRP partner online repositories, where these exist. The portal has already been

³ <http://www.cgiar.org/resources/open>. The non-CGIAR strategic partners in the CRP have formally agreed that their contributions to this CRP will match these principles.

adapted to conform to CG Core standards and was originally designed to incorporate interoperability standards. This primary platform will also be integrated into the relevant components of the planned 'big data' platform.

- For research data management, the new CRP will draw on systems and tools developed by ILRI and its partners for the efficient and high-quality collection and management of research data. These include a primary focus on electronic data collection, on processes which capture the various auditing and cleaning aspects of managing data well, and on the use of relational databases with detailed meta-data.
- Many of these platforms and tools already use CGcore, Dublin core and other standard taxonomy as well as standards to facilitate discovery and inter-operability. This will be extended to all platform as far as possible. Quality assurance and consistency is built into the workflows of each different platform and system.
- In general, it is proving easier to obtain complete databases of information products – articles, reports and the like, and the move towards open access content is advancing as scientists understand why and how they need to do this, and funders require it. Much more difficult has been to get data curated and indexed, so that it becomes more easily accessible. This requires a lot of effort to devise institutional and individual motivations and rewards/penalties. The CRP expects to make progress in these areas as part of wider CGIAR (and individual centre-led) initiatives to explain, promote and support the necessary changes and investments.
- Issues around open access and open data are closely linked to IA management as well as to research communication. The CRP will manage these areas in a coordinated way, inputting to CRP planning and reporting cycles and drawing on the mix of legal, technical and professional skills involved in these areas. This coordination will be driven through the shared base of the three areas in the management function and through the production of an annual CRP-wide assessment of progress, results and plans. An early task of this group is to document capacities in the CRP partners – and elsewhere in the CGIAR – that could be drawn upon.
- As with IA management, a strong advantage in this area is the relatively common CGIAR-wide approaches already being followed and the opportunity to learn and benefit from problems and solutions found elsewhere.

Open access and data management strategies, assets and platforms

Open access and research data management plans have been developed by each of the participating CGIAR centres and these provide details on the various platforms used and under development.

The table on IA and dissemination pathways in Annex 3.9 gives global information on the various strategies the program will use to ensure its IAs are widely disseminated and where there may be limitations to this.

The table below provides information on some of the open source platforms and tools that will be used to enhance the accessibility of the program's data and information products. Each strategic partner also publishes other specialized tools and resources and the program will work with them to make sure any supported by the program are made as openly accessible as possible.

Livestock CRP open access and data management resources	
Resource	Notes
Open Data Kit	Used by projects across the Program to collect data and for storage and analysis
CGSpace	Information products repository used by Livestock and Fish Program as well as CIAT, ICARDA and ILRI https://cgspace.cgiar.org
ILRI data portal	Data repository used by Livestock and Fish Program and ILRI http://data.ilri.org/portal
ILRI tools portal	Index to software tools and applications used by Livestock and Fish Program and ILRI http://data.ilri.org/tools
ILRI source portal	Repository of software source code used by ILRI https://github.com/ilri
ILRI biorepository	Long-term storage system and associated informatics tools supporting ILRI's unique collection of pathogen isolates http://azizi.ilri.cgiar.org
CIAT datasets	Data repository by ILRI https://ciat.cgiar.org/data-information-knowledge/datasets
Policies	Institutional policies and guidelines http://ilri.org/open https://ciat.cgiar.org/intellectual-assets-policy/open-access http://www.icarda.org/IntellectualProperty http://www.slu.se/en/library/publish/

Budget and resources

Issues around open access, open data and research data management (RDM) are closely linked to IA management as well as research communication. The CRP will manage these areas in a coordinated way, inputting to CRP planning and reporting cycles and drawing on the mix of legal, technical and professional skills involved in these areas. This coordination will be driven through the shared base of the three areas in the management function and through the production of an annual CRP-wide assessment of progress, results and plans. An early task of this group is to document the capacities of CRP partners – and others in CGIAR – that could be drawn upon.

Over time, bilateral projects will also budget for open access, open data and RDM. Promoting and requiring this will be part of the CRP strategy to achieve the global accessibility its aims for. Until all projects properly budget these areas, the CRP will co-finance critical open access and open data investments as well as strategic platforms at the CRP level that add value and synergies and make dispersed knowledge findable and re-usable.

Each flagship has budgeted these activities. There is variation across the flagships, depending on their pipeline of activities and the data-intensiveness of their research. Some maintain important global databases and associated tools as part of their core agendas – and these also require support from the CRP.

While there is much decentralized effort going on, these activities will be guided from within the central CRP management function, which will also act as a supporter and catalyst to improve access to the CRP's research.

Resources to support these activities include:

1. Staff within the management unit for general coordination and oversight at CRP level
2. Variable staff time within each flagship for specific data curation and open access support
3. Dedicated budgets in flagships and at CRP level for data curation and open access support
4. Dedicated CRP and flagship level funds to support open journal articles
5. Costs budgeted into bilateral projects
6. Funds that contribute to current open access data and information products repositories and their management, as well as associated work on quality control, standards, discovery, etc.

The table below gives a summary overview for intellectual assets, open access, research data management and communication across the CRP. Given synergies among them, these items were planned and budgeted together in this proposal, and will be managed and reported together in the future. Important to note for this annex is the additional investment in data management by the Livestock Genetics flagship which expects to recruit additional specialised bioinformatics capacities linked to the various CGIAR platforms.

Budget estimates for intellectual assets, open access, research data management and communication in the Livestock CRP (For 2017-2022, assumes 5% growth held constant at CRP and across all FPs and sources of funding)								
Year 1 - 2017	Total CRP/Flagship	of which...	IA	OA	OD	Comms	All	% total
Livestock Genetics flagship	\$10,549,446		\$ 2,400	\$ 30,000	\$ 193,892	\$ 51,400	\$ 277,692	2.6%
Livestock Health flagship	\$7,970,185		\$ 2,400	\$ 30,000	\$ 40,000	\$ 36,000	\$ 108,400	1.4%
Livestock Feeds and Forages flagship	\$6,598,000		\$ 2,400	\$ 23,200	\$ 32,000	\$ 35,000	\$ 92,600	1.4%
Livestock and the Environment flagship	\$5,305,958		\$ 2,087	\$ 20,870	\$ 17,391	\$ 61,739	\$ 102,087	1.9%
Livestock Livelihoods and Agri-food Systems flagship	\$8,134,718		\$ 2,400	\$ 24,000	\$ 50,400	\$ 24,000	\$ 100,800	1.2%
Sub-total Flagships	\$ 38,558,307		\$ 11,687	\$ 128,070	\$ 333,683	\$ 208,139	\$ 681,579	1.8%
Management & cross-cutting budget	\$2,408,620		\$ 48,000	\$ 54,000	\$ 90,000	\$ 217,900	\$ 409,900	17.0%
Strategic Investment fund	\$ 2,533,074		\$ 11,399	\$ 11,399	\$ 11,399	\$ 11,399	\$ 45,595	1.8%
Total	\$ 43,500,001		\$ 71,086	\$ 193,469	\$ 435,082	\$ 437,438	\$ 1,137,074	2.6%
Entire Program - 2017 - 2022	Total CRP/Flagship	of which...	IA	OA	OD	Comms	All	% total
Animal Genetics flagship	\$ 71,756,412		\$ 16,325	\$ 204,057	\$ 1,318,836	\$ 349,618	\$ 1,888,837	2.6%
Animal Health flagship	\$ 54,212,503		\$ 16,325	\$ 204,057	\$ 272,077	\$ 244,869	\$ 737,327	1.4%
Animal Feeds and Forages flagship	\$ 44,879,021		\$ 16,325	\$ 157,804	\$ 217,661	\$ 238,067	\$ 629,857	1.4%
Livestock and the Environment flagship	\$ 36,090,664		\$ 14,196	\$ 141,956	\$ 118,292	\$ 419,943	\$ 694,387	1.9%
Livestock Livelihoods and Agri-food Systems flagship	\$ 55,331,643		\$ 16,325	\$ 163,246	\$ 342,816	\$ 163,246	\$ 685,633	1.2%
Sub-total Flagships	\$ 262,270,242		\$ 79,494	\$ 871,121	\$ 2,269,683	\$ 1,415,743	\$ 4,636,041	1.8%
Management & cross-cutting budget	\$ 16,383,223		\$ 326,492	\$ 367,303	\$ 612,172	\$ 1,482,137	\$ 2,788,104	17.0%
Strategic investment fund	\$ 17,229,748		\$ 77,534	\$ 77,534	\$ 77,534	\$ 77,534	\$ 310,135	1.8%
Total	\$ 295,883,214		\$ 405,986	\$ 1,238,424	\$ 2,881,855	\$ 2,897,880	\$ 7,424,145	2.5%

Annex 3.9 Intellectual assets management

All the strategic partners are committed to the principle of global accessibility of CRP research outputs as international public goods (IPGs) and as a general means to achieve impact. They also recognize that achieving multiple levels of impact sometimes requires restrictions to global accessibility. The CRP strives to reach a balance between maintaining global accessibility and proactively achieving targeted impacts by using Intellectual Property Rights (IPRs) and licensing to ensure that specific local or other outcomes are reached through appropriate public, public–private or other partnerships.

Such intellectual property protection on its products and technologies may be necessary to: ensure continued public availability of germplasm, inventions, publications and databases and prevent their mis-appropriation; ensure the delivery of improved products and technologies in developing countries; and negotiate access to other proprietary rights and technologies required for product development.

Partners in the program may seek to protect their products by obtaining intellectual property protection through patents, copyrights, trademarks, trade secrets etc, where this is justified by the need for further improvement or to enhance the scale or scope of impact on target beneficiaries. In negotiating collaborative arrangements for the development of products, the partners will strive to ensure unrestricted access by small-scale producers and other key stakeholders in developing countries to the products of the research.

Compliance will be incorporated within Collaborative Research Agreements (CRAs) that spell out principles and any limitations and include taking an inventory of intellectual assets (IA) at the start of a project, listing expected project technology, e.g. data, processes or formulations that are to be created, compiled, conceived or reduced to practice within the project, and any project inventions.

Each of the CRP strategic partners has its policies and guidelines on the management of IA⁴. Those of the CGIAR partners conform to CGIAR principles and implementation guidelines. The lead centre will ensure that all CRP participants (including other partners, to the extent possible) follow the CGIAR Principles for the Management of Intellectual Assets and the CGIAR Open Access and Data Management Policy.

The following principles, derived from the CRP lead centre's [policy and guidelines](#), govern the acquisition, production, management and dissemination of the CRP's research outputs:

- Producing (international) public goods – this is central to all CRP activities
- Using IPR protection – negotiated in certain circumstances to drive outcomes at scale where partners can be given more ownership of some aspects of the product
- Forming public–private partnerships (PPPs) – to access, where appropriate, third party know-how and to share resources and ownership of results where this is likely to lead to impact at scale
- Incorporating third party IA – negotiating access to proprietary products from others that will lead to impacts at scale, but may mean sharing ownership back to original asset providers and, in some cases, limiting wider dissemination of certain assets
- Maximizing global accessibility and impact – ensuring that all intellectual products of the CRP are findable, accessible, inter-operable and Re-usable.

⁴ <http://www.cgiar.org/resources/open>. The non-CGIAR strategic partners in the CRP have formally agreed that their contributions to this CRP will match these principles.

Implementation issues and challenges

- The CRP theory of change identifies two interlocking over-arching impact pathways: the generation of local and international public goods on the one hand, and achieving targeted uptake and impacts at scale on the other (on a continuum from local to global scales).
- For the first, IPG, pathway, the program will ensure proper documentation, wide dissemination and open access to public goods – information products and data, know-how as well as models, tools and other innovations. It has well established channels and tools for this. For the second pathway, the CRP will ensure that the ‘local’ and often informal products of location- and system-specific and targeted testing, adaptation and prototyping research are also made as accessible as possible (recognizing location, community and linguistic specificities).
- To ensure impact at ‘local’ levels, previous work in the Livestock and Fish and other CRPs shows that the program has to work with private, semi-public and public organizations whose commitment to partner and development outcomes may require limiting or delaying the full global accessibility of a specific innovation. Such cases will be documented, justified and reported. This is especially the case where technologies – vaccines, new forage seeds, or insurance schemes, for example – require private-sector involvement to take outputs to scale.
- Issues encountered here often revolve around diverging CGIAR and private-sector interests, concerns about confidentiality obligations (including the need to maintain trade secrets and delay disclosure of information so as to allow time to patent inventions), lack of IA knowledge and policies by national partners, and the need to meet relevant national legal requirements. The program will address these issues through legal instruments, transfer agreements, licenses and capacity development, as appropriate.

Traditional research outputs, such as articles, reports, multimedia communications and the like, are not expected to pose major IA management challenges. The program will draw on existing and emerging open access, open data and publishing channels and platforms of all its partners to handle these.

Dissemination pathways

The program aims to generate discrete technologies focused on increased livestock (and feed/forage) productivity, together with analytical tools, novel institutional arrangements, policy options and intervention strategies, assembled and widely shared for the benefit of small-scale production and marketing systems in the target countries and globally.

Key dissemination pathways to maximize global impact are summarized in Table 3.9a (and elsewhere in proposal sections on open access and open data, partnerships, communication, etc.). Capacity development also has a critical role in dissemination, accompanied by the translation, or adaptation of research outputs into products that can be widely applied. The dissemination pathways include open access repositories, appropriate licensing, adapted information channels to specific target groups, partnership approaches and capacity development, management of products as IPGs, partnerships, scaling up and out, networks, innovation platforms and participatory research.

Managing intellectual assets

Four program-wide areas are currently envisioned for IA management:

1. Capturing, tracking and disseminating IA
 - a. Reaching target beneficiaries in accordance with CGIAR principles and guidelines by:
 - b. Aligning dissemination pathways with CGIAR IA principles and requirements (with legal advice)

- c. Ensuring freedom to operate with CRP outputs
- 2. Evaluating and monitoring dissemination pathways consistent with CGIAR policies
- 3. Ensuring that all memoranda, contracts and other legal agreements of the CRP are consistent with CRP policies
- 4. Handling licensing of research and development outputs to meet CGIAR policies as well as (sometimes contradictory) local, national and regional laws and practices.

Specific IA management strategies will include:

- i. A partner due diligence assessment (value proposition) – this will be undertaken to ensure partners’ capability, compatibility of goals, cooperative culture, complementarity of resources and commitment to best practices and global access objectives
- ii. IP compliance – this will be managed through the various agreements (and associated templates) between the lead centre and all partners. It will include MoUs, confidentiality agreements, PPAs, MTAs, service agreements, data sharing agreements and licensing agreements.
- iii. Freedom to operate assessments – all research partners will be required to complete a Background IP due diligence form, annexed to their PPAs, to identify and address hurdles (e.g. through licenses, MTAs) to the program’s ability to use and make available program outputs as public goods. Program IP inventory forms and Invention/Discovery disclosure forms will be provided to partners and will be required to be submitted as part of annual reporting requirements. This will ensure proper documentation and systematic identification and management of research results and IP assets and ensure that third party IP is accessed and used in a fair and appropriate way. This information will be consolidated into a central database (such as Salesforce) by the lead centre.

These management activities will be coordinated by the lead centre and CRP management unit and will include: IA tracking; negotiation and drafting of agreements with partners; compliance with international treaties; compliance with national laws and regulations; ethics in research and privacy protection; and cross-CGIAR coordination.

The lead centre and its IP manager, working closely with IP managers in partner organizations, will review and authorize all legal agreements, e.g. exclusive licenses, restricted use agreements, patent protection etc, and verify their compliance with the CGIAR IA principles (consulting the CEO as needed).

IA management will intervene in the following parts of the CRP and project management lifecycle:

Phase	Intervention from IA
Design	Ensure that proposals submitted properly budget for IA and associated implementation; check investor requirements; assess legal aspects
Planning	Direct and/or participate in drafting of documents for work plan, data management, knowledge management, and dissemination of results Handle contractual obligations and agreements with partners
Implementation	Draft and negotiate agreements As needed, monitor work scope, risk issues and legal issues Advise on and draft IPR or commercial licenses, if necessary Assist with any audits, if necessary Produce CRP-level annual report
Completion	Administrative close-out, monitor permanent accessibility of products and materials, including any special confidentiality or access limitation clauses

Throughout the research to development cycle, the program will engage researchers and project managers in planning and decisions around accessibility, so that they are fully aware of the issues and can ensure the right balances are achieved. These decisions will be brought into bilateral projects as well as CRP investment decisions, budgeting and accountability.

Issues around IA cut across, connect and drive related activities in communication, research data management and open access, partnership and capacity development. The CRP will manage these issues in a coordinated way, inputting to CRP planning and reporting cycles and drawing on the mix of legal, technical and professional skills needed. This coordination will be driven through production of an annual CRP-wide assessment of progress, results and plans. An early task of this group is to document the capacities in the CRP partners – and elsewhere in CGIAR – that could be drawn upon. A strong advantage in this area is the increasingly consistent CGIAR-wide approaches already being followed and the opportunity to learn and benefit from problems and solutions found elsewhere.

Budget and resources

The CRP will not recruit its own legal and IA management expertise, as this is provided through the partner organizations (estimated as 0.5 FTE collectively). The CRP will, however, ensure that support is available through the management unit (and the adoption of consistent legal agreements etc, providing for IA management). This, together with the existing CGIAR community of practice, will provide necessary legal inputs, help ensure consistency, and support and catalyze improved access to the CRP's research.

Beyond specialized legal advice and inputs, most IA principles and outcomes are delivered through the integrated work and the platforms and tools for publishing, open access, open data, curation, knowledge management, communication (and capacity development) described and budgeted elsewhere.

The CRP recognizes that IA and IP issues vary across flagships. Each has therefore identified its specific issues and budgeted resources for legal advice and inputs, especially for issues around the commercialization of research outputs or shared IP.

Resources to support IA activities include:

- 1 Services of ILRI IP manager for general coordination, oversight, monitoring agreements, advice, reporting
- 2 IP and legal inputs to flagships on specific issues.
- 3 IP and legal inputs budgeted into bilateral projects

The table below gives a summary overview for intellectual assets, open access, research data management and communication across the CRP. Given synergies among them, these items were planned and budgeted together in this proposal, and will be managed and reported together in the future. Under the management unit, funds are provided to generate an annual report from all these areas.

Budget estimates for intellectual assets, open access, research data management and communication in the Livestock CRP
(For 2017-2022, assumes 5% growth held constant at CRP and across all FPs and sources of funding)

Year 1 - 2017	Total CRP/Flagship	of which...	IA	OA	OD	Comms	All	% total
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Sub-total Flagships	\$ 38,558,307		\$ 11,687	\$ 128,070	\$ 333,683	\$ 208,139	\$ 681,579	1.8%
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Livestock Livelihoods and Agri-food Systems flagship	\$ 55,331,643		\$ 16,325	\$ 163,246	\$ 342,816	\$ 163,246	\$ 685,633	1.2%
Sub-total Flagships	\$ 262,270,242		\$ 79,494	\$ 871,121	\$ 2,269,683	\$ 1,415,743	\$ 4,636,041	1.8%
Management & cross-cutting budget	\$ 16,383,223		\$ 326,492	\$ 367,303	\$ 612,172	\$ 1,482,137	\$ 2,788,104	17.0%
Strategic investment fund	\$ 17,229,748		\$ 77,534	\$ 77,534	\$ 77,534	\$ 77,534	\$ 310,135	1.8%
Total	\$ 295,883,214		\$ 405,986	\$ 1,238,424	\$ 2,881,855	\$ 2,897,880	\$ 7,424,145	2.5%

Table 3.9a Livestock CRP intellectual assets and dissemination pathways

Intellectual asset	Dissemination and impact pathways	Activities	Examples
Information products (publications, multimedia, reports, manuals, learning materials)	Open access repositories Data repositories and databases Open educational resources Open licences Adapted IP rights Partnerships	Repositories, standards, taxonomies for sharing and re-use Use of global open licenses Agreements with third party publishers Open access support for authors IPR management strategies and advice Legal advice Communication and engagement: publishing, media outreach, use of social media Use of ICTs (phones, video, radio, etc) Workshops, engagement processes, conferences etc	CGSpace repository learning.ilri.org open access learning platform
Data, datasets, databases, models	Capacity development Targeted dissemination, translation and adaptation to specific groups (policy makers, farmers, etc)		Africa RISING data portal FEAST online aggregator
Software and applications	Science communication Development communication Participatory research and innovation platforms Scaling through partners		Ng'ombe Planner
Know-how (protocols, how-to guides, toolkits, learning and training, best practices, Institutional arrangements)			Tropical forages selection tool: www.tropicalforages.info
Germplasm	Utilization PPPs Participatory development IP rights and licenses International treaties National laws Capacity development	Licenses and agreements to access and give access to germplasm, including SMTA/MTAs; Legal advice Databases and data dissemination Open access repositories Svalbard storage	CIAT forages collection: isa.ciat.cgiar.org/urg/foragecollection.do
Biological materials, samples, pathogens	Public access biorepository	Dissemination strategies	http://azizi.ilri.org/
Financial products	Public-private partnerships Scaling through partnerships	Legal advice Dissemination strategies Capacity development	
Vaccines and diagnostics	Private sector Public-private partnerships	Legal advice Freedom to operate opinions Dissemination strategies	
Improved livestock	Public-private partnerships	Databases of breeds and traits	http://dagris.info/

breeds and cross-breeds and platforms underpinning genetic improvement	Multiplication, delivery and scaling through partnerships Gene-edited livestock	Training resources and capacity development Legal advice Informing public opinion	http://agtr.ilri.cgiar.org/
Improved bred grass cultivars	Public-private partnerships	Legal advice Contracts and agreements Royalty sharing	See IA section 2.3.1.11 of Livestock Feeds and Forages flagship
Community and farmer knowledge	Participatory research Value chain development Livelihood systems development	Ethical standards Farmer rights Use of traditional and community knowledge Prior Informed Consent Legal advice Dissemination strategies Innovation platforms Participatory communication and social learning	Innovation platform briefs: cgspace.cgiar.org/handle/10568/33667 Africa RISING engagement standards: cgspace.cgiar.org/handle/10568/34830
Genomic tools, forage crop ontologies, and phenotyping platforms	Open access publications		
DNA, RNA, enzymatic and analytical methods and processes for use in biotechnology discovery and/or trait development, including but not limited to transformation tools and methods, promoters, proteomics, introns, enhancers, genome editing, DNA and RNA modification tools etc	Public sequence databases Research partnerships	Legal advice Databases and data dissemination Access to third party technologies Freedom to operate opinions Use of patents Dissemination strategies	See IA section 2.1.1.11 of Livestock Genetics flagship

Annex 3.10.1 Addressing the grand challenges

The proposed agenda and the multiple roles of livestock mean that nearly all the grand challenges identified in the SRF are addressed:

Competition for land: Continued efforts to improve the animal feed value of residues from food crops and increasing animal productivity rather than numbers will both be instrumental in reducing pressure on available land.

Soil degradation: Through better rangeland and manure management strategies and soil-enhancing forage technologies, livestock enterprises can help reverse degradation.

Overdrawn and polluted water supplies: Increasing livestock productivity reduces inputs, including water, per unit product, while proper waste management is central to supporting sustainable intensification. Appropriate rangeland management through livestock grazing can enhance vegetation and thus mitigate excessive run-off.

Climate change: Increasing productivity will reduce GHG emissions per unit of milk, meat or eggs produced. Technical options, such as robust livestock breeds, can be developed for their adaptation to changing climatic conditions, while institutional strategies to enhance resilience, such as indexed-based livestock insurance schemes, will also contribute to adaptation. Mitigation can be achieved through well managed livestock grazing, which can lead to greater carbon sequestration in rangelands than with no grazing. Planting forages can have similar effects.

Diminishing genetic resources: The conservation of animal genetic resources is targeted, as well as better use of forage genebank materials. Both have the potential to enrich the diversity of production systems.

Nutrition, diets and diverse agri-food systems: Increasing the production of animal-source foods should improve the quality of diets among poor people. More attention will be given to how to ensure these nutrient-rich products reach women and children, especially in urban areas and in unimproved rural systems. Higher and more stable income from livestock enterprises also implies better nutrition, as part of the income is typically spent on food.

Post-harvest losses and food safety: Continued development of the value chain approach initiated under the Livestock and Fish CRP offers opportunities to increase processing and handling efficiencies and introduce improved food safety all along the value chain from farm to fork.

New entrepreneurial and job opportunities: Again, the value chain approach has already demonstrated a range of opportunities attractive to young people and women. There are opportunities not only for adding value to livestock commodities but also within the auxiliary value chains that provide inputs and services to livestock farmers.

Annex 3.10.2 Ex-ante impact assessment of CRP Livestock proposals

Introduction

As an input into the development of the proposal, Ross McLeod (eSYS Development Pty Limited), was commissioned to carry out a rapid ex-ante impact assessment of the various streams of research proposed in the Livestock CRP using methods from a 1999 research prioritization exercise carried out by ILRI. This annex presents his report and findings. Input into the exercise was provided by flagships during proposal development so there may be some small inconsistencies between the cluster texts here and in the final Flagship narratives.

Summary

The proposed Livestock Agri-Food Systems CRP is quantitatively evaluated using the priority setting framework developed to assess the comparative advantage, new opportunities and expected impact of ILRI research in 1999 (Thornton *et al* 2000, Randolph *et al* 2001). It combines scoring methods and economic surplus benefit-cost approaches - in a composite weighted index. Criteria include expected economic impact, contribution to poverty alleviation, environmental impact, internationality of the problem and contribution to capacity development. Inclusiveness is included as a criterion in this update to reflect its importance in the CGIAR Strategic Results Framework 2016-2030. A total of 21 research streams are identified across the five flagships of the proposed CRP. Many research streams cut across flagship clusters, typically establishing proof-of-concept, piloting and scale-up of new products and practices. They are ranked using the composite index.

Results of the impact assessment show that each of the flagships have at least one highly ranked stream. There is considerable variability in the relative contribution of each criterion to the composite index. High benefit-cost ratios are estimated for improved poultry and pig genetics, integrated herd health, enhancing existing vaccines, cultivar development, on-farm optimisation and market linkages streams. The environmental cluster was ranked highly for environmental impacts on GHGe, water use and soil resources, whereas capacity development impacts were perceived to be most pronounced in optimisation and markets and policies. Inclusiveness was scored highly in the gender stream, along with environmental and policy and optimisation streams.

Probabilities of success are of particular importance in economic return calculations. They were estimated for each research stream using the benchmarks of the 1999 impact study and varied from a low probability of 17 percent to a high chance of success of 50 percent. Streams such as nutrition, novel vaccines and the mitigation of greenhouse gases are deemed to be higher risk streams, whereas markets and policies, and development of an integrated herd health package are low to medium risk. CGIAR Consortium Office (2015a) CRP proposal development guidance highlights the need to manage the risks of running an R&D pipeline dry to achieve short term results at the expense of discovery science, or on the other hand, to over-invest in discovery science.

This risk appears to be well addressed in proposed CRP. Higher and lower risk investments have been balanced to achieve a sound forecast economic return (e.g. benefit-cost ratio) as an overall portfolio benefit-cost ratio of 9:1 is calculated. This compares relatively well with reviews of the economic impacts of CGIAR research. Raitzer and Kelley (2008), for example, found a benefit-cost ratio range of 9-17 for project economic evaluations with plausible designs and with some extrapolation. Each flagship of the proposed CRP has a stream which was ranked in the top third of all ranked streams in this impact assessment. No flagship seems to score dramatically less than others, which suggests a sound thematic balance.

Overview

CGIAR's second comprehensive Strategy and Results Framework (SRF) focusses on reduced poverty, food and nutrition, enhanced natural resources systems and the inclusiveness of women and young people in development (CGIAR-CO, 2015b). The Livestock Agri-Food Systems CRP pre-proposal was well aligned with the SRF, however, more explicit prioritization of W1 and W2 budgets, enhancing coherence of the portfolio, and better integration with system-level outcomes was recommended by both the donors at the November 2015 Rome meeting and the CGIAR Independent Science and Partnership Council (ISPC) to allow systematic assessment of its potential value. Specifically, the proposal was encouraged to demonstrate that priority research opportunities had been selected on comparative advantage, new opportunities and expected impact. This report outlines the impact assessment process undertaken to meet these recommendations.

Methods

A priority setting framework was developed and previously used in an impact assessment process across ILRI in 1999 (Thornton *et al* 2000, Randolph *et al* 2001). It combines scoring methods and economic surplus benefit-cost approaches - in a composite weighted index. Criteria include expected economic impact, contribution to poverty alleviation, environmental impact, internationality of the problem and contribution to capacity development and research efficiency. To reflect more recent System-level priorities, an inclusiveness criterion has now been added. The calculated result for each criterion are weighted in the composite index which is used to rank research streams in the proposed CRP on livestock portfolio.

Ranking criteria

Expected economic impact. The expected economic impact is estimated using a cost-benefit approach underpinned by an economic surplus model. Economic benefits are the total net gains realised directly by users of R&D outcomes and indirectly by other participants in the value chain or the community at large. A clear understanding of the anticipated direct production system impact is essential. There are three aspects which need to be considered. These are the size of the gain to typical users within different agro-production systems, the number of users realising the gain (relevance in target system and adoption), and the likelihood that R&D will be successful in delivering the anticipated impacts.

Contribution to poverty alleviation. The extent and severity of poverty in each system was used to calculate a severity of poverty index which combines an income measure adjusted for societal inequity. The calculation of these indices are outlined in Thornton *et al* (2000). Results of the cost-benefit analysis (Present Value Benefits) in each of the systems are related to poverty as economic benefits per poor person, economic benefits per poor person adjusted for severity of poverty, numbers of poor per dollar of economic benefit and economic benefits per production system weighted by poverty severity. These calculations are used to assess the poverty impact dimensions of research streams. Research streams which are estimated to have large economic benefits falling in systems - with greater numbers of poor (and those with higher income inequality) - have highest poverty impact.

Environmental impact. Each research cluster was assessed for potential environmental impact, public health impact (zoonotic diseases) and its effect on genetic diversity of domestic plant and animal resources. Direct and indirect environmental impacts were considered. Direct impacts were scored for soil resources, water resources, greenhouse gas emissions, and non-domesticated biodiversity. Soil impacts include erosion (soil loss on site) and on soil fertility (organic matter and nutrients). Water resources impacts cover quality of water (levels of organic and inorganic nutrients, sediments, toxins) and available quantity of water. Scores are outlined in tables 6 to 9 (at the end of this annex) and are combined as an environmental aggregate rating.

Internationality of the problem and solution. Internationality was estimated using the Simpson Index of Diversity. This variable gives greater priority to research activities that raise producer and consumer welfare in several parts of the world. A research stream that generates relatively small economic gains but in several regions has a higher internationality score than research that had a relatively large aggregate impact that is concentrated in one region (Thornton *et al* 2000).

Contribution to capacity development and research efficiency. The recent CGIAR CO (2015c) capacity development framework includes 10 elements and a minimum set of composite indicators, which reflect the SRF's capacity development Intermediate Development Outcome (IDO) and four sub-IDOs. The degree to which clusters are anticipated to impact on enhanced institutional capacity of partner research organizations, enhanced individual capacity in partner research organizations through training and exchange, increased capacity for innovations in partner research organizations and increased capacity for innovation in partner development organizations and in poor and vulnerable communities were scored as low, medium or high. The results of the scoring are provided in tables 6 to 9.

Inclusiveness. Research streams were scored by their perceived contribution to youth employment and income, gender analysis to improve technology development and gender analysis to progress towards gender equity. If research activities and outputs have a direct focus on the sub-criteria, then impact is considered to be 'important' and given a value of 2. If activities and outputs have an indirect focus on any of these four sub-criteria, then impact is considered to be 'incidental' and is given a value of 1. Research having no impact was given a score of zero.

Criteria Weighting. Each of the five criteria outlined above (economic impact, poverty, environment, internationality, capacity development-research efficiency-research tools) were assigned weights in the 1999 impact assessment approach by the Steering Committee, the focus groups, and ILRI's Board of Trustees (Thornton *et al* 2000). The final baseline weights were 0.30 for the economic impact index, 0.25 for the poverty index, 0.20 for the environmental impact index, 0.15 for the capacity development index, and 0.10 for the internationality index. These weights are largely again used in this report when calculating the composite index value. As inclusiveness has been given prominence in the CGIAR SRF it is included at a weight of 0.10 and all other weights from 1999 reduced proportionally. The ISPC (2015b) noted that no robust list of priorities or method for prioritizing resources currently exists. A CGIAR donor online sub-IDO priority survey was launched during June-July 2015; however, only 19 of the 70 target respondents completed the survey (ISPC, 2015b). Reduced poverty was nominated as the highest priority SLO. Increased productivity and increased incomes and employment were the highest rated IDOs, followed by climate change, capacity development and gender cross-cutting themes. These priorities reflect the weights elicited in the impact approach in 1999 plus the addition of inclusiveness in this evaluation of the proposed CRP.

Impact Assessment Process. An impact assessment consultant was engaged by ILRI in February and March 2016 to update criteria and lead economic evaluation and scoring. Scoring and elicitation of economic impact parameters were conducted during the CRP planning workshop at Lake Naivaisha in mid-February when the proposal was being consolidated. A semi-structured interview template was developed to facilitate estimation of key parameters such as probability of research success or eventual adoption rates and productivity gains. Flagship and cross cutting theme leaders provided estimates. They were reviewed during revisions of the impact assessment drafts by the M&E team.

Research streams

The proposed CRP portfolio had to be disaggregated into research streams that lead to product or practice delivery at scale in order to undertake impact assessment. Clusters largely aligned with research phases in each Flagship. Typically, the first cluster involves priority setting or discovery, the

second proof-of-concept and the final two clusters piloting and scale-up. The manner in which each of the flagships are split into streams is described for each of the Flagships

Four streams are identified in the Livestock Genetics Flagship. The first stream (ANGR1: ANGR Prioritization and Information Base) is the current cluster one – which focusses on prioritization and generating a genetic information base. Research streams are identified for poultry, dairy and community based ruminant breeding. They are denoted ANGR2, 3 and 4 in the following table. Resources from Clusters 2, 3 and 4 are attributed to each of these streams of work. The rationale for this approach is that without Cluster 3 and 4 support, identification and proof-of-concept research in Cluster 2 would have no adoption; and therefore limited economic benefits.

Table 1: Livestock Genetics Flagship Research Streams

Research Outcomes (RIDOs)	Quantified Benefits for Impact Assessment
Cluster 1: Assessment of systems and resources for development of strategies on AnGR utilization	
The body of knowledge about genetic diversity and systems will be enhanced, such as through the linking of physical samples from the ILRI biorepository. It is envisaged this information will be used 20 research projects in 2019 and 35 in 2022	ANGR1: ANGR Prioritization and Information Base. Improved breeding program efficiency and targeting through the use of livestock system characterization and intervention analysis, enhanced repository of information on distribution, and assessment of genome diversity. The stream is estimated to improve the productivity gains in the poultry, dairy and small ruminant research undertaken in Cluster 2 than would otherwise have been the case. It is estimated productivity is improved by an additional 1%.
Clusters 2, 3 and 4: Improved breeds of livestock, multiplication and delivery systems of improved genetics and policy and institutional support clusters	
Research in these clusters will increase the genetic merit of existing populations through the introduction of new breed-types, and their pilot testing and potential scale-out. Business models will be developed to increase adoption through improved multiplication and delivery of livestock genetics. Policies on animal genetic resource use, ownership, improvement and conservation, as well as supporting institutional arrangements will support sustainable adoption of improved genetics. Research will require follow-on costs after pilots and testing supported under core and bilateral funding ceases. National program costs are assumed to be substantial.	ANGR2. Poultry and Pig Improvement. The stream supports the distribution of brooded and pre-vaccinated chicks that are adapted to typical low-input systems in poor rural communities. Mixed farming system in Ethiopia, Tanzania, and Nigeria are the key target systems. Cluster 2, 3 and 4 resources attributed to poultry genetics are included as resources for the economic evaluation and scoring.
	ANGR3. African Small Holder Dairy Productivity. The stream aims to identify and generate wider adoption of adapted dairy cow breed types - such as crossbreds between indigenous breeds and commercial exotic dairy breeds. The investment will help overcome the current lack of systems for production or multiplication of these breeds, limited farmer knowledge of how to optimally manage these cows and no systematic and sustainable breeding currently being undertaken. Small holder dairy in East Africa is the key target system.
	ANGR4. Small Ruminant Community Breeding. Community-based breeding programs for small ruminants in low-input, communal grazing systems in Ethiopia will continue to be piloted. Mixed humid and arid systems in Africa are the key targets for improved sheep breeds.

The four clusters of the Livestock Health Flagship are interlinked and organised into four streams for economic evaluation and impact assessment. Cluster 1 ‘Evaluate animal health constraints and threats’ focusses on investigating disease burden and threats to help the targeting of research activities in

clusters 2, 3, and 4. The economic analysis of this cluster assumes that productivity benefits generated by the other clusters are greater as a result of this targeting.

Cluster 2 ‘Improve herd health management’, includes research to improve drug use, developing tools to provide intervention packages for disease and reproductive health constraints as well as the threat of drug resistance. Cluster 4. ‘Develop delivery models to improve access to animal health services and products’ aims to improve access to animal health inputs developed under Cluster 2. The adoption of an integrated approach to animal health is assumed to be significant due to the combined research in Clusters 2 and 4. These two clusters are combined for economic evaluation. Cluster 3 involves the development of diagnostics and vaccines to improve animal health control. This cluster is split into 3 research streams for evaluation. The first involves diagnostic development, the second - improving the performance of existing vaccines and the third – development of novel vaccines.

Table 2: Livestock Health Flagship Research Streams

Research Outcomes (RDOs)	Quantified Benefits
Evaluate animal health constraints and threats	
Deploy methods and tools that can be used in developing countries to identify the extent and impact (on animal productivity and livelihoods) of animal health constraints. National research partners will be trained to use tools in priority locations. Results of risk assessment will influence research in clusters 2-4 and other flagships	AH1. Animal Health Priority Setting Tools. (AH1). By 2019, tools will be applied in four priority locations and inform research in clusters 2-4 and by 2022, the tools will be applied in settings outside the CRP priority locations. Their use will enhance the productivity impact of other research streams in the flagship.
Improve herd health management, including drug use, to optimize livestock productivity	
Context specific herd health management packages will be tested and adopted by farmers, extension and animal health workers in Ethiopian small ruminant, dairy in East Africa/India and pigs in Uganda systems. Animal health/extension workers in selected priority locations will use the new tools for identifying the most critical herd health interventions to be made.	AH2. Animal Health Service Delivery and Integrated Approach. Research will be conducted on the priority value chains and systems to assess how productivity, reproduction, and functional traits are influenced by health status and how different control mechanisms such as biosecurity, drug use, vaccines etc. can be optimally deployed in different systems. Constraints to the delivery of animal health products and services will be assessed. Packages will be developed to address delivery constraints in order to reduce the impact of major diseases. Animal health will improve in priority sites as result of adoption of these packages. Cluster 2 and 4 resources will contribute to this impact.
Develop diagnostics and vaccines to improve animal disease control programs	
By 2019, vaccine candidates are taken up for safety and efficacy testing and CRP researchers are undertaking novel vaccine research adapted according to stop-go decision points.	AH3. Animal Health Diagnostic Tests. Tests developed for ruminant mycoplasmas and point of care tests for cysticercosis.
	AH4. Enhanced Existing Vaccines. Product development of existing vaccines, e.g. scale up of a thermostabilized protocol for a PPR vaccine, CBPP vaccine evaluation and backstop delivery of the live East Coast fever (ECF) vaccine.
	AH5. Novel Vaccine Development. Longer-term research on new vaccines for the control of African swine fever, contagious bovine/caprine pleuropneumonia (CBPP/CCPP), and ECF.
Develop models to improve access to animal health services and products	
Better understand the institutional constraints to the access of services and	These resources are included in the above research streams to improve adoption. The proposal notes that by 2019, two

products, and to provide evidence through research to underpin the development of more efficient and gender-responsive ways to deliver animal health products to end-users.	value chain countries will have developed plans for integrated delivery and by 2022 at least four priority locations are implementing changes to improve animal health services delivery.
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The Livestock Feeds and Forages Flagship has four clusters. Cluster 1: Diagnosis of feed constraints and opportunities and decision support tools will prioritise and target feed and forage interventions. Cluster 2 will aim to develop new forage and feed cultivars. Cluster 3 will investigate feed sources as well as exploring the use of technology to make biomass more available. Cluster 4: will support activities to delivery and increase the uptake of feed and forage technologies. Three research streams are identified for impact assessment.

Table 3: Livestock Feeds and Forages Flagship Research Streams

Research Outcomes (RIDs)	Research Streams and Quantified Benefits
Technology and knowledge platform: assessment and diagnosis of feed constraints and opportunities	
Refined tools that incorporate gender and youth dimensions for assessing the role of feeds and forages and targeting feed interventions in priority location. NIRS protocols, NIRS/MIR/pXRF equations for soil-plant analysis, and a platform of genomic and high-throughput phenotyping tools and technologies will be into breeding programs for selected forages.	FF1. Feed Tools and Information Base. The research will develop, adapt and extend tools to assess biological and socio-economic aspects of feed demand–supply scenarios, improve ration balancing, and enhance feed and forage substitution options. It will extend the phenotyping capabilities for comprehensive feed, forage and fodder quality traits using stationary and mobile near infrared spectroscopy (NIRS) hubs in Africa, Asia and Latin and Central America. It is assumed the research will increase the productivity of research impacts for Cluster 2 and 3 in priority locations.
Development of new feed and forage options, and better use of existing and new feed resources	
Superior Brachiaria, Megathyrus, Pennisetum, and Opuntia (Cactus pear) planted forage cultivars made available to development partners and private sector. Improved feed and traits will be developed for maize, millet, pigeon pea and selected legumes in key cereal and legume crops.	FF2. Superior Forage Cultivars. Improved cultivars will increase feed and forage biomass availability in Latin America, South Asia, Africa and to a limited extent in SE Asia. Improved ‘full purpose’ nutritional quality for South Asia and Africa. Full-purpose crop research will also result in improved by-products for feed use and approaches for rangeland improvement will be addressed. This stream includes Cluster 2 resources for identification and Cluster 4 for scale-up.
Better utilization of existing and novel feed and forage resources, and clustered outputs linked to feed processing, feed surplus/deficit scenarios, ration balancing, and improved forage/feed conservation and preservation. Scalable drying and ensiling protocols for smallholders will be developed to conserve feeds and by-products, appropriate agronomic practices (including irrigated forage) will be developed to improve the productivity and nutritional quality of diverse grass, legume, tree and rangeland forage species and biomass processors/fermenters evaluated	FF3: Improved Feeding Strategies. Livestock producers will apply management strategies to conserve and rehabilitate rangelands while ensuring ongoing production to produce, preserve and store feed biomass. Livestock keepers in priority locations will use simple processing and supplementation options that reduce feed costs. This stream includes Cluster 2 resources for identification and Cluster 4 for scale-up.
Delivering feed, forage and fodder technologies	

Increased uptake and impact of improved feeds and forages in diverse environments, with a particular focus on uptake and impact on women farmers. Forages will be integrated into the national varietal registration, basic seed production systems expanded, and formal and informal feed enterprises strengthened involving private and public sector partners. At least 50% of livestock keepers in at least three priority locations will use simple processing and supplementation options that reduce feed costs. Research costs from this cluster included in FF2 and FF3 to increase adoption.

The Livestock and the Environment Flagship is split into 4 research streams. Cluster 1 supports LE1 – systems analysis and learning. Much of this research will provide an environmental lens for other flagships. In Cluster 2, the flagship will work in dairy systems and pastoral/agro-pastoral systems in priority locations in Ethiopia, Kenya, Burkina Faso, Tunisia, Nicaragua and Vietnam. The cluster is split into three streams for evaluation. The first, will support research designed to minimise GHGe in East African dairy, Nicaraguan cattle and Vietnamese pig production. LE3 includes Cluster 2 and 3 research to improve water flow management. LE4: Improved NRM in Rangeland Systems provides management recommendations for rangeland systems of Northern Kenya, Ethiopia, Burkina Faso, Nicaragua, and Tunisia that will enhance the longer term productivity and reduce land degradation and biodiversity impacts of livestock production in these systems. The third cluster aims to develop and support improved institutions and other governance mechanisms for environmental solutions. Research will assist key policies being implemented in priority locations, which leads to more widespread and longer term adoptions of environmental management options developed in Cluster 2.

Table 4: Livestock and the Environment Flagship Research Streams

Research Outcomes (RDOs)	Benefits Quantified for Impact Assessment
Assessing the environmental sustainability and adaptability of livestock production technologies	
By 2019, the CRP's framework approach is widely adopted by extension systems, development partners and government agencies to identify win-win options. Quantification of environmental impacts guides selection of productivity enhancing options by research and development partners. By 2022, environmental concerns become a key issue for target users of flagship research outputs, including technology developers seeking to improve dairy, small ruminants and pig production. Targeted solutions are used by research and development partners to increase productivity in the face of on-going environmental changes.	LE1: LE Systems Analysis and Targeting. Livestock production systems are analysed in its specific context, taking into account variations across regions, climate zones and cultures - identifying the most promising opportunities to increase livestock production in an environmentally sustainable way. This stream improves the longer term productivity benefits of the other streams in this flagship.
Optimize natural resource use and enhance the provision of ecosystem services	
Research will enhance the body of knowledge about environmental management in target systems through quantification of environmental benefits. This will help in the selection and further development of management options by development and research partners. Results will be synthesised into management options for livestock production that will be piloted with local communities and stakeholders. By 2022 it is envisioned that government and development partners at local and national levels are capable of implementing environmental management options.	LE2: Reduced Greenhouse Gas Emissions (GHGe). Feeding and other farm practices to minimise GHGe in East African dairy, Nicaragua cattle and Vietnamese pig production, along with improving longer term productivity will be developed.
	LE3: Enhanced Water Flow. Management practices will improve nutrient flow and sustain watershed management in East African dairy, Nicaragua cattle and Vietnamese pig production, along with improving longer term productivity
	LE4: Improved NRM in Rangeland Systems. Technical solutions embedded in management recommendations for rangeland systems of Northern Kenya, Ethiopia, Burkina Faso, Nicaragua, and Tunisia will be developed to enhance longer term productivity and reduce land degradation and biodiversity impacts.
Develop and support improved institutions and other governance mechanisms for environmental solutions	
Support will be provided to stakeholders in their efforts to develop and implement technical and institutional solutions to manage the interactions between livestock and their environment. Stakeholder's policies and institutions will be developed and strengthened that can support strong environmental management of livestock production systems. The cluster will focus on the priority dimensions identified in Cluster 2 being: land degradation, biodiversity, mitigation of GHG emissions, and sustainable use of water - but provide institutional support for taking options in this cluster to scale.	

The Livestock Livelihoods and Agri-Food Systems Flagship has the aims of contributing to increased availability of diverse nutrient-rich foods by enhanced availability and consumption of animal-source food, improving gender analysis, contributing to reduced market barriers for livestock products, supporting increased livelihood opportunities through optimization of farming systems and enhancing household capacity to cope with shocks. The research is integrated with other flagships. Each cluster is evaluated as a standalone stream.

Table 4: Livestock Livelihoods and Agri-Food Systems Outcomes and Quantified Benefits

Research Outcomes (RDOs)	Research Streams and Quantified Benefits
Foresight & system analysis tools	
By 2019, analyses and learning for the livestock sector are used to guide international research in priority locations and national and international development partners apply new partnership and institutional approaches.	LRN1: Foresight & system analysis tools. Methods and datasets will be applied in priority settings and investments made to better take CGIAR livestock research to scale. Analyses and learning for the livestock sector are used to guide international research in priority locations. This is assumed to increase productivity of targeted livestock systems across the portfolio.
Gender Analysis	
Gender dimensions of livestock research will be better understood to enhance equitable opportunities for women and men participants in livestock communities. Decision and policy makers will adopt institutional frameworks that support gender equity.	LRN2: Gender Analysis. Methods and datasets will be applied in priority setting. Decision maker's awareness of gender dimensions will be improved to enhance equitable opportunities for women and men in livestock communities. Livestock-keeper communities will support and adopt gender equitable norms. Enhanced asset allocation is assumed to generate indirect productivity benefits in target systems.
Enhanced nutrition through livestock	
New options on nutrition-sensitive and cost-effective technologies will be identified, and institutional arrangements and behavioural approaches in animal-source food value chains tested by local partners in four value chains.	LRN3: Enhanced nutrition through livestock. Increased availability of diverse nutrient- rich foods. Malnutrition has significant implications for cognitive development of children, thereby contributing to poor educational outcomes, as well as implications for labour productivity of adults. This streams aims for a ten percent increase in supply of animal-source food by 9 million smallholders. This will have longer term productivity benefits.
Optimizing livestock systems for productivity and resilience	
Livelihood systems will be analysed and understood in terms of the roles of livestock income and assets, productivity, resilience, nutrition, gender and social relations; and the livelihood and income opportunities and constraints to system optimization. Optimal herd management practices for pastoral systems developed and underpinned by acceptable trade-offs between improvements in productivity, economic considerations, environmental impacts and management options for adapting to climatic variability and climate risk.	LRN4: Optimizing Livestock Systems. Technologies, management strategies and institutional arrangements will be developed through livestock systems optimization tested by national and international research and development partners. This will lead to increases in whole farm productivity through improved crop tree livestock interactions in mixed systems and herd and grazing management in pastoral systems.
Enabling policies, markets and institutions	
Institutional arrangements for inclusive market linkages that enhance value chain performance tested and are being used by national and international development partners, producers, private sector value chain actors and government agencies in priority locations.	LRN5: Enabling Policies, Markets and Institutions. National and international development partners, private sector, value chain actors and government agencies apply innovative institutional arrangements to enhance competitiveness, inclusiveness and value added potential of animal-source food systems. This will enhance the efficiency of livestock markets and production systems.

Economic analysis assumptions

The size of the gain to typical users within different agro-production systems, the number of users realising the gain (relevance in target system and adoption), and the likelihood that R&D will lead to a successful development impact drive the magnitude of economic benefits. Each of these elements are outlined in this section prior to assumptions for each research stream being presented.

Target Production Systems and Relevance Domain. The global livestock production system was disaggregated into the agro-climatic classification by Sere and Steinfeld (1996) for World Bank regions and typical benefits estimated for producers within each respective system. Livestock product volumes were estimated for each system using FAOStat data and ILRI spatial databases for 2012 (FAO, 2016). An adoption ceiling is defined by specifying the extent of the problem being addressed by the research stream (relevance domain) within each regional system and the maximum proportion of producers within that domain likely to adopt the end product or practice derived from each of the research streams. The extent of the problem within each production system is evaluated using benchmarks outlined in Thornton *et al* (2000). They include the problem being described as widespread (83%), moderately present (67%), moderate (50%), limited-moderate (34%), limited (17%) or not present at all. Maximum adoption within each of the relevance domains is governed by demand factors such as simplicity of the technology to be adopted, affordability and perceived need or usefulness by farmers. Supply factors include available infrastructure for delivery and presence of extension services. Thornton *et al* (2000) rated maximum adoption as low (0-10% ceiling adoption), medium (10-20%), and high (25%) for each relevance domain. These benchmarks are again used in this impact assessment.

Productivity Gains. Gains are estimated for an average animal in each system adopting the technology at scale. They are typically lower than those observed during on-station trials, as other constraints such as nutrition, herd health and stresses hinder the potential gains a technology may provide. Yield gaps have been estimated for Indian and Ethiopian livestock producers as part of the recent Bill and Melinda Gates Foundation supported LiveGAPS Project. For example, improved feeding and promoting changes in the herd structure towards more crossbreeding was estimated to increase total Indian milk production by 60 percent in 15 years (Herrero *et al* 2015). More conservative estimates of productivity gain are included in this impact assessment. They range from a very high productivity gain assumption of 15-20% for genetic improvement of cross-bred poultry in Africa and planted forages in Central America to indirect productivity gains of 0.1% where research is indirectly impacting productivity through priority setting or fore sighting. Benchmarks from Thornton *et al* (2000) are generally used in this impact assessment. They include a high productivity gain of 5% in a small target area, medium gain of 3% in well-defined target areas, low as a 1% direct productivity gains and low-low (0.1 %) indirect productivity gains in a large area where impacts are difficult to define. These productivity gains are diluted by adoption and probability of success, so expected gains are far less than those of the LiveGAPS Project. Estimated portfolio returns in the impact assessment are, however, in line with plausible estimates of returns for CGIAR research outlined by Raitzer and Kelley (2008). These authors reviewed impacts from the suite of completed CGIAR economic impact studies until 2008. Comparison of their results with those in this impact assessment is discussed in the results section.

Research Lag. The time lag between start of the R&D investment (2017) and the first commercial use or farmer adoption of a technology is referred to as research lag. The time taken from project commencement to the first commercial use of the technology is important because the longer the time before the realization of benefits, the greater the attractiveness of the research investment is reduced. Future benefits are discounted using a discount rate. Benefits captured earlier have a higher economic value than benefits projected at later years.

Adoption Lag. The period between the end of the research lag and attainment of the adoption ceiling constitutes the adoption lag. Lags are specified for each research stream. Comparative advantage of the CRP has been considered using depreciation rates. Benefits are reduced by differing rates per year,

reflecting that technologies may have been delivered in the absence of CRP research. The year in which depreciation begins indicates the competitive lead time the CRP has over other potential developers of similar technology. Short lead times indicate private or other public agencies would have developed a similar product or practice in a relatively short time frame (15 years) in the absence of CRP investment. Longer time frames of 30-40 years indicate there are no other potential technology developers. Short leads include development of poultry genetic materials by the private sector, whereas high risk IPGs would not be supported by industry. The CRP has a long competitive lead time in such cases.

Probability of Success. The final aspect in the estimation of total net gains is the likelihood that a R&D investment will be successful in ultimately delivering the anticipated benefits. For overall success, the discovery, proof-of-concept, pilot and scale up phases must meet *all* their desired objectives. The probability of success is therefore conditional on the success of each phase. As an example, if the probability of success for a research stream bridging three phases was 67% for each phase, then the overall probability of research stream success would be 30%. Because of these risks, research benefits need to be weighted accordingly and expressed in terms of an expected benefit to the funds invested. This is done simply by multiplying annual stream benefits by the probability of success. Thornton *et al* (2000) estimate probabilities ranging from 17 percent (low) to 83 percent (high). A similar range is included in this impact assessment.

Economic Model and Pay-Off. FAO livestock product volume and price data are included in an economic surplus model. The model is based on that of Alston *et al* (1995) for closed economies, as most livestock products are consumed in the regions of production. Demand and supply elasticities are specified for beef, milk, sheep meat, pork, chicken meat and eggs using Thornton *et al* (2000) data. Total, producer and consumer surpluses are estimated for the productivity gain and other economic assumptions described above. Total economic surplus is projected and related to research stream costs to calculate a benefit-cost ratio. The benefit-cost ratio describes the number of dollar or economic benefit for each dollar of research investment. For example, a ratio of 8:1 indicates for each dollar of investment, \$8 (current \$) of benefit are expected.

Research Stream Costs. The resources required to deliver research stream products and services at scale are measured using projected W1/2 resources and secured bilateral funds for each research stream. Follow-on financing for adaptive research, development of products customized to specific geographical areas, and other aspects of delivery borne by the public sector are estimated. They are described as being high (twice estimated annual research costs), same (equal to annual research costs) or low (half of current research costs). Annual projections are made until the expected year of commercialisation for products to be delivered by the private sector, and until maximum adoption for products and practices extended by government agencies and the international donor community.

Table 5: Research Streams Economic Analysis Assumptions.

Livestock Genetics Flagships Economic Analysis Assumptions

Target Production Systems and Relevance	Productivity Benefit	Adoption and Lags	Chance Success
ANGR1: Genetics Prioritization and Information Base.			
Improved breeding program efficiency and targeting through the use of livestock system characterization and intervention analysis in the poultry, dairy and small ruminant streams of research undertaken in Cluster 2 than would otherwise have been the case. It is estimated that livestock productivity is improved. All systems being targeted for improved genotypes are assumed to benefit.	Improve productivity gains by 1% across target systems and species in Cluster 2 and 3	Maximum adoption and lag assumptions are outlined in the next three evaluations for each species.	34%
ANGR2. Poultry and Pig Improvement			
Half of urban, other, mixed arid and humid rain fed and irrigated poultry and a similar proportion of pigs in the same systems in Sub-Saharan Africa are assumed to be relevant domains. The research stream supports brooded and pre-vaccinated chicks that are adapted to typical low-input systems in poor rural communities. Similar pig genetic improvement is included, largely in Uganda.	Current indigenous types produce 40 eggs /hen /year and need six months to achieve a market live-weight of less than 1.5kg. Significant productivity improvement can be achieved, with local lines producing between 150 to 200 eggs/hen/year and attaining 2.0kg live-weight at 10-12 weeks of age under low-input production using locally available feed resources. A high productivity gain assumption of 20% is included in the economic evaluation	A low maximum adoption (5% of pig and poultry relevance domain) was assumed. Sub-Saharan Africa mixed farmers were noted in the proposal as lacking an understanding of the potential of indigenous livestock genetic resources for productivity improvement; heterogeneity of livestock systems, and farm-scale limiting adoption. Research and adoption lags of 3 and 10 years are included. 15 years are included before research benefit depreciation.	34%
ANGR3. African Small Holder Dairy Productivity			
Dairy production in Sub-Saharan Africa is the key domain for the research. A moderate (50%) proportion of mixed humid and arid systems (irrigated and rain fed), urban and other are assumed to be relevant.	The productivity gain is assumed to be high. (20%). The proposal noted that smallholder farmers with crossbred cows achieve higher milk yields (1,400 kg/lactation) compared to local cows (400 kg/lactation). Productivity gains are driven by feed availability and disease prevalence	The proposal states that farmers know that crossbreds between indigenous breeds and commercial exotic dairy breeds are preferred, but no systems currently exist for their production or multiplication. A low-medium maximum adoption of 10% is assumed. Research and adoption lags of 6 and 15 years due to the generation time of large ruminants. Benefit depreciation starts in 2047.	34%
ANGR4. Small Ruminant Community Breeding			
Community-based breeding programs in Ethiopia were set up in four locations representing different production systems and agro-ecologies. Moderate (50%) of humid and arid mixed and livestock only small ruminant systems in Sub-Saharan Africa and Middle-East North Africa were estimated to relevant	Early research in Ethiopia found live weights (three and six months' weights) were heavier and gains (pre and post weaning weights) were faster (at least $p < 0.05$) for the base year of the community trial in that country. Results have improved as the trial has progressed. A 40% increase in overall off-take is targeted for health, nutrition and breeding	Since 2009 Ethiopian community-based sheep breeding programs are being implemented in three locations. System-wide adoption will be limited by the ability to scale up community programs. A low- maximum adoption target (5%) of the relevance domain is estimated. Research and adoption lags of 2 and 20 years are assumed. Adoption lag is long due to the time to expand participating communities.	34%

	improvement. A 15% improvement is assumed for genetic improvement.		
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Livestock Health Flagships Economic Analysis Assumptions

Target Production Systems and Relevance	Productivity Benefit	Adoption and Lags	Chance Success
AH1. Animal Health Priority Setting Tools			
Research will involve risk assessments and studies on risks of emerging diseases, including tick distribution and vector-borne diseases. It is assumed all systems being targeted by research in Clusters 2-4 will benefit from improved strategy and disease management priority setting.	It is assumed that the productivity benefits of research in these clusters will be improved by 0.1% as a result of the research	The relevance domains, adoption, lags and year of depreciation are those for each of the development outcomes quantified for streams cross Clusters 2-4. These assumptions are outlined in the next sections of the chapter.	50%
AH2. Animal Health Service Delivery and Integrated Approach			
It is envisioned that small ruminant production in Ethiopia, dairy in East Africa and India, and pigs in Uganda will be the priority systems. Interventions will be combined and tested in site-specific herd health packages. It is assumed that demand for improved animal health practices are widespread in mixed humid and arid (rain fed and irrigated) livestock systems in pig, dairy and small ruminant production across Sub-Saharan Africa. A moderate (50%) relevance domain for ruminants and for pigs is assumed.	Packages of this nature are estimated to improve productivity by 3%. Integrated approaches consider productivity, reproduction, and functional traits, along with how different control mechanisms such as biosecurity, drug use, vaccines can be optimally deployed.	A low-medium maximum adoption assumption of 10% is used for all systems. Extension of information packages is labour intensive which curtails scope for system-wide adoption. A research lag of 3 years and adoption lag of 10 years are assumed. Benefits are depreciated from 2030.	50%
AH3. Animal Health Diagnostic Tests			
Contagious caprine pleuropneumonia (CCPP) is a cause of major economic losses to goat producers in Africa and Asia and is caused by the Mycoplasma genus, while Contagious bovine pleuropneumonia afflicts cattle across a similar range. They mainly impact pastoral production systems. A moderate relevance of 50% is included for these systems. Porcine cysticercosis is found in urban and higher density systems. A relevance of 34% in mixed humid and urban systems is included.	The test is replacing already used diagnostics (eg. ELISA) so the productivity gain is assumed to be low (1%).	The proposal notes that targeted tests maybe more difficult to make and are usually more expensive on a per sample basis. Tests are likely to be limited to government services, so a low-medium maximum adoption rate of 10% is assumed. Research and adoption lags of 5 and 10 years are included.	50%
AH4. Enhanced Existing Vaccines			
East Coast Fever or Theileriosis is primarily caused by the protozoan parasite Theileria parva and found in 11 countries of eastern, central and southern Africa. Around 30 million cattle are at risk from the disease. The disease is most important in small-scale intensive dairying and commercial cattle production systems where highly productive exotic breeds of cattle are raised. Peste des petits ruminants (PPR) can severely affect small ruminants in	ECF, CBPP and PPR cause substantial productivity losses. The proposal notes that mortality rates vary according to breed, nutritional status, age class and whether the disease is endemically stable. Mortality can be as high as 80-100% in areas of endemic instability. Backstopping and evaluation	Live theileriosis vaccines have been commercialised but has not been widely adopted. Low adoption is thought to result from cold-chain requirements for live vaccine, substantial veterinary administration costs, potential for adverse animal reaction, strain specific immunity and possibility of introducing new ECF strains. PPR vaccines	50%

almost 70 countries in Africa, the Middle East and parts of Asia. A 34% relevance is included for ECF, while widespread relevance of 67% is included for Africa and South Asia for PPR. Limited relevance of 17% is included in Asia for China. Contagious bovine pleuropneumonia afflicts cattle across a similar range. They mainly impact pastoral production systems. A moderate relevance of 50% is included for these systems	will improve the efficacy of existing vaccines. A low productivity gains of 1% is assumed	are used in Africa and Asia. CBPP vaccines are used in Africa. Low to medium adoption of 10% is assumed	
AH5. Novel Vaccines			
Bovine and caprine mycoplasma diseases are widespread across Asia, Africa and Latin America. East Coast Fever is found in 11 countries of eastern, central and southern Africa. s widespread across Africa with half of the continents countries reporting outbreaks in 2012. Moderate relevance is assumed for ASF and mycoplasma vaccines, while limited relevance is assumed for ECF across East and Southern Africa.	Vaccines are routinely used in Africa for Contagious bovine pleuropneumonia. A vaccine does not exist for ASF. ECF usage is limited due to cold chain needs for the current live product. Average productivity benefits of 5% are assumed across the developed vaccines.	Adoption is likely to be amongst commercial farmers and by public sector organisations. A low maximum adoption of 5% is assumed. Research lag includes 20 years for proof of concept, scale-up and registration. An adoption lag of 10 years is included. A long competitive lead time is included.	17%

Livestock Feeds and Forage Flagships Economic Analysis Assumptions

Target Production Systems and Relevance	Productivity Benefit	Adoption and Lags	Chance Success
FF1. Feed R&D Priority Setting Tools and Information Base			
Feed research will be undertaken in value chain priority locations	The research is assumed to improve the productivity of C2 and C3 research by 0.1%.	These assumptions are estimated to be the same as those for C2 and C 3 streams being assisted by the research.	50%
FF2. Superior Planted Forage and Full Purpose Crop Cultivars			
There are planted forage and 'full purpose crop development objectives in this stream. Brachiaria grasses will be further developed for Central American conditions. Disease resistant Pennisetum will be selected for East Africa and Opuntia (Cactus pear) cultivars for rangelands in South Asia. 'Full purpose' crop development includes millet and maize for South Asia and pigeon pea and beans for Africa and West Asia. It is assumed that 50% of mixed humid systems in the Americas are relevant for planted forages and a similar portion of mixed systems in South Asia and North Africa for full purpose crops.	Brachiaria grasses in South and Central America have the potential to greatly increase carrying capacity in Latin America. Productivity increases of as high as 300% were stated by the research team. Productivity increases of 20% are included for this species. 3% productivity increases are included for the other planted forage and full purpose crop development options.	A maximum adoption of 5% of relevant domains is included. Research and adoption lags of 8 and 10 years are included. Follow-on financing is required to extend improved cultivars.	34%
FF3: Improved Feeding Strategies			
The improved feeding strategies cluster is dominated by the nitrogen fixation in East Africa and a rangeland project is included in Cluster 4 which is accommodated this stream. Moderate relevance in livestock only arid and humid systems for nitrogen	A 3% productivity gain is assumed.	Limited awareness and use of livestock feed preservation practices further compound the situation, exacerbating the vulnerability of production to extreme weather events. A maximum adoption of 5% of relevant	50%

fixation in Africa, and livestock only arid ruminant systems for rangeland feed development are included as domains for this stream (50%). Some adoption amongst small-ruminant producers in South Asia and Mekong also included using Cluster 4 funds.		domains is included. Research and adoption lags of 8 and 10 years are assumed.	
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Livestock and the Environment Flagship Economic Analysis Assumptions

Target Production Systems and Relevance	Productivity Benefit	Adoption and Lags	Chance Success
LE1. Environmental Systems Analysis and Targeting			
The proposal notes the cluster will cover livestock systems in priority locations in Ethiopia, Kenya, Tanzania, Burkina Faso, Nicaragua and Vietnam. Further analyses (with cluster 1 of the Transformation and Scaling flagship) will inform work in other locations, especially in North and Southern Africa, and Central Asia.	The use of an environmental lens will enhance environmental impacts across all flagships, which is captured in scoring and in many cases will also improve longer term productivity. The indirect productivity assumptions of 0.1% across production systems targeted by the CRP sites is included.	The relevance and adoption assumptions are assumed to be the same as for the technologies which are being evaluated using environmental impact approaches	34%
LE2. Reducing Greenhouse Gas Emissions (GHGe)			
Emissions management research will focus on livestock in smallholder systems and assess possible nutritional/management interventions which will reduce emissions. Intensive dairy and beef production systems in East Asia, Central America and Africa are the targets of this research program. The moderate (50%) relevance domain benchmark is included.	A 1% productivity gain is assumed to be associated with this research. A low probability of achieving on-farm productivity gain is included, as much of the benefit from this stream is captured within environmental criteria. Incentives for farmers for adoption maybe limited if no feed efficiency gain can be attained.	Results and methodologies will be communicated in close cooperation with ILRI's on-going projects such as dairy value chains. A low maximum adoption of 5% is included. Research and adoption lags of 5 and 10 years are included.	17%
LE3. Improved Water Use of Livestock Systems			
Improved water use will investigate options for improving water and nutrient flows in priority sites. Vietnam, East Africa and Central America are a focus. Strategies will be developed to ensure sustainable water use at basin and landscape scale, in terms of water quality and quantity. Half of mixed humid (rain fed and irrigated) systems in these regions could benefit from improved water flow management	A 1% productivity gain is assumed to be associated with this research	Maximum adoption is limited. The proposal notes that potential solutions are highly context-specific and that careful evidence-based design and targeting of interventions is needed. A maximum adoption of 5% is included. Research and adoption lags of 5 and 10 years are included	34%
LE4. Rangeland Management			
The cluster will develop technical solutions for rangeland systems of Northern Kenya, Ethiopia, Burkina Faso, Nicaragua, and Tunisia - enhancing longer term productivity and reducing land degradation and biodiversity impacts. Half of mixed and livestock only arid (rain fed and irrigated) systems in these regions could benefit from improved rangeland management. A 50% relevance assumptions is included.	Experience from Niger found restored tree cover increased crop and fodder production, with associated restoration of ecosystem processes. The project proposal notes there have been few objective quantitative studies of the benefits in terms of ecosystem services provided. A low productivity assumption of 1%	Community-based NRM projects are context specific and adoption of results are more site-focused when compared to many product development research activities. A low expected maximum adoption of 5% of the relevance domain is assumed for all systems	34%

Livestock Livelihoods and Agri-Food Systems Flagship Economic Analysis Assumptions

Target Production Systems and Relevance	Productivity Benefit	Adoption and Lags	Chance Success
LRN1: Foresight & System Analysis Tools			
The regional focus of this flagship will be in sub-Saharan Africa, south and southeast Asia, and Central America. It will work on value chains and systems in Kenya, Ethiopia, Tanzania, Uganda, Burkina Faso, India, Vietnam and Nicaragua. Identifying priority interventions are likely to have wide application across the target production systems. All systems covered in the CRP are assumed to be relevant, with 67% relevant domains for African and 17% for East Asian and Pacific systems.	Analyses and learning for the livestock sector will be used to guide international research partner priority research areas in priority locations. It is assumed that productivity will be increased as a result of this type of research. A 0.1% gain assumed	Community based breeding, new diagnostics, animal health packages, forages and enhanced management practices are assumed to have limited adoption. It is assumed to be 10% across all target systems.	34%
LRN2: Gender Analysis			
The regional focus of this flagship will be in sub-Saharan Africa, south and southeast Asia, and Central America. It will identify priority interventions are likely to have wide application across the target production systems. Half of sub-Saharan Africa mixed systems and 17% of East Asian pig production systems are assumed to be relevant.	It will encourage livestock-keeper communities to support and adopt gender equitable norms; and decision and policy makers adopt institutional frameworks that support gender equity. It is assumed that productivity will be increased as a result of this type of research. The Thornton <i>et al</i> (2000) approach assumed a 0.1% productivity benefit	Gender analysis will be integrated into tools and methodologies for priority setting, learning and assessing impact by developing gender-sensitive indicators, and methodologies to assess progress on gender strategic change. It is assumed to be 5% across all target systems	34%
LRN3: Enhanced Nutrition Through Livestock			
The regional focus of this cluster will be in sub-Saharan Africa, Middle East and North Africa and Central Asia. Nutrition-sensitive and cost-effective livestock and animal-source food-related interventions, including food technology, and policy interventions have widespread relevance to arid and humid dairy and small ruminant producers in rain fed and irrigated areas conducting mixed and livestock only farming. The stream integrates with other research streams in genetics, health and forages.	Malnutrition has significant implications for cognitive development of children, thereby contributing to poor educational outcomes, as well as implications for labour productivity of adults. This is largely a stream where value is captured through public health scoring in the environmental criteria. Improvements in human health are best captured using metrics such as disability adjusted life years. A 0.1% indirect productivity benefit for policy research across large production systems is included using benchmarks, as some productivity benefit would be achieved through improved labour efficiency	A key outcome is that national and international development partners, government agencies and private sector are more aware of the role of animal-source food and other livestock-mediated pathway. A low maximum adoption of 5% is assumed. A relatively high risk is included due to complicated impacts pathways involving numerous agencies. Research and adoption lags of 5 and 10 years included. Benefits are depreciated from 2032 as a range of agencies are involved in nutrition research.	17%
LRN4: Optimizing Livestock Systems			
Vietnam pig production, Ethiopia small ruminants, Kenya dairying and Uganda pig production are the key targets Priority interventions are likely to have wide application across the target production systems. Animal health, forage and poor access to	Technologies, management strategies and institutional arrangements developed through livestock systems optimization will be tested in priority locations. It is assumed whole farm	Improved management options and products are likely to adopted by a limited proportion of the sector. Community based breeding, new diagnostics, animal health packages, forages and enhanced management	50%

improved genetics are broad issues for priority production systems across Asia, Africa and Latin America. Half of mixed systems in humid rain fed and irrigated dairy in Sub-Saharan Africa, 17% of mixed pig production in East Asia and the Pacific and half of Sub-Saharan Africa; and small ruminant production in mixed and livestock only arid and humid systems of Sub-Saharan Africa and Middle East and North Africa are assumed to be relevant.	productivity will be increased by 3% through improved crop tree livestock interactions in mixed systems and herd and grazing management in pastoral systems.	practices adoption is limited by the capacity of extension to diffuse results. It is assumed maximum adoption will be 5% across relevance domains of all target systems. Research and adoption lags of 5 and 10 years are included.	
LRN5: Enabling Policies, Markets and Institutions			
A similar assumption of half of the above systems are relevant. Many of these areas suffer from animal-source food value chains that are underperforming and research could contribute to a policy environment favourable to their development are relevant areas.	A 3% direct productivity gain is assumed	The proposal notes the main beneficiaries will be poor smallholder livestock keepers, poor consumers who rely on local, often informal, markets for their food and many of whom are also producers. 10% maximum adoption across all target systems with similar lags as LRN4 are assumed.	50%

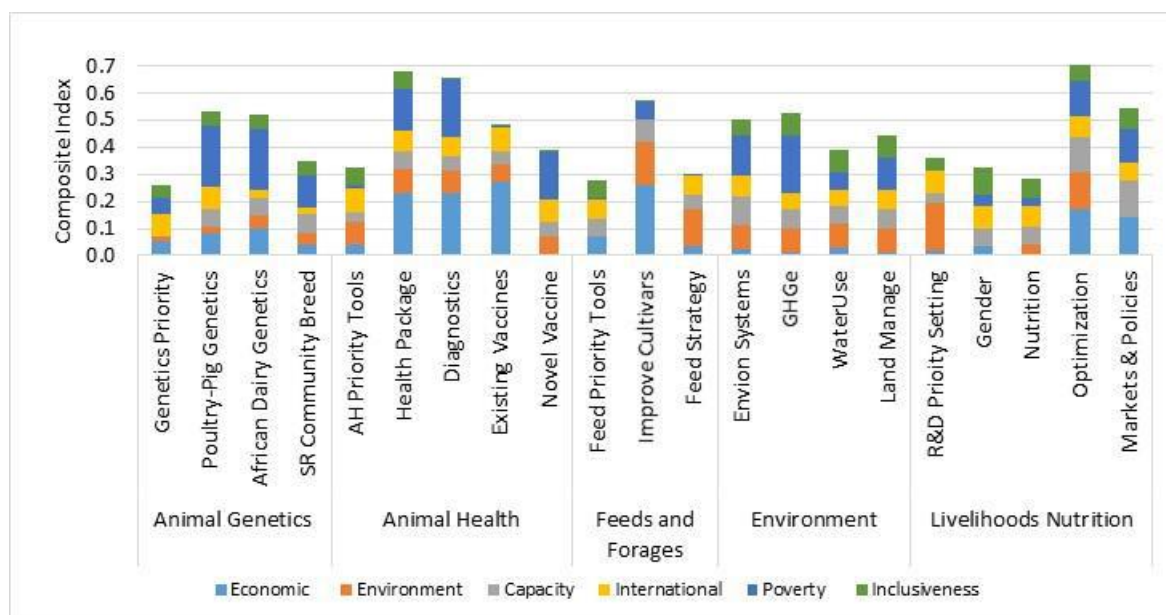
Results

Composite index

Streams are ranked according to the composite index in tables 6 to 9, with number 1 being the highest ranked and the others numbered in descending order. The dark shading indicates that the highlighted stream is ranked in the top third of the portfolio for each criterion. Results are also presented in the figure below, with the contribution of the various components to the composite index score indicated. Similarly, to the 1999 impact assessment results - a large proportion of streams had similar results. Nearly a third the streams have composite index values between 0.3 and 0.4.

It is evident that each of the flagships have at least one highly ranked stream. There is considerable variability in the relative contribution of each criterion to the composite index. High benefit-cost ratios are estimated for improved poultry and pigs, integrated herd health, enhancing existing vaccines, cultivar development, on-farm optimisation and market linkages streams. The environmental cluster was ranked highly for environmental impacts on GHGe, water use and soil resources, whereas capacity development impacts were perceived to be most pronounced in optimisation and markets and policies. Inclusiveness was scored highly in the gender stream, along with environmental and policy and optimisation streams. The rationale underpinning each of these results and implications for portfolio design are discussed in the following sections relating to each criterion.

Figure 1: Composite Index for 21 Research Streams



Source: Calculations this study

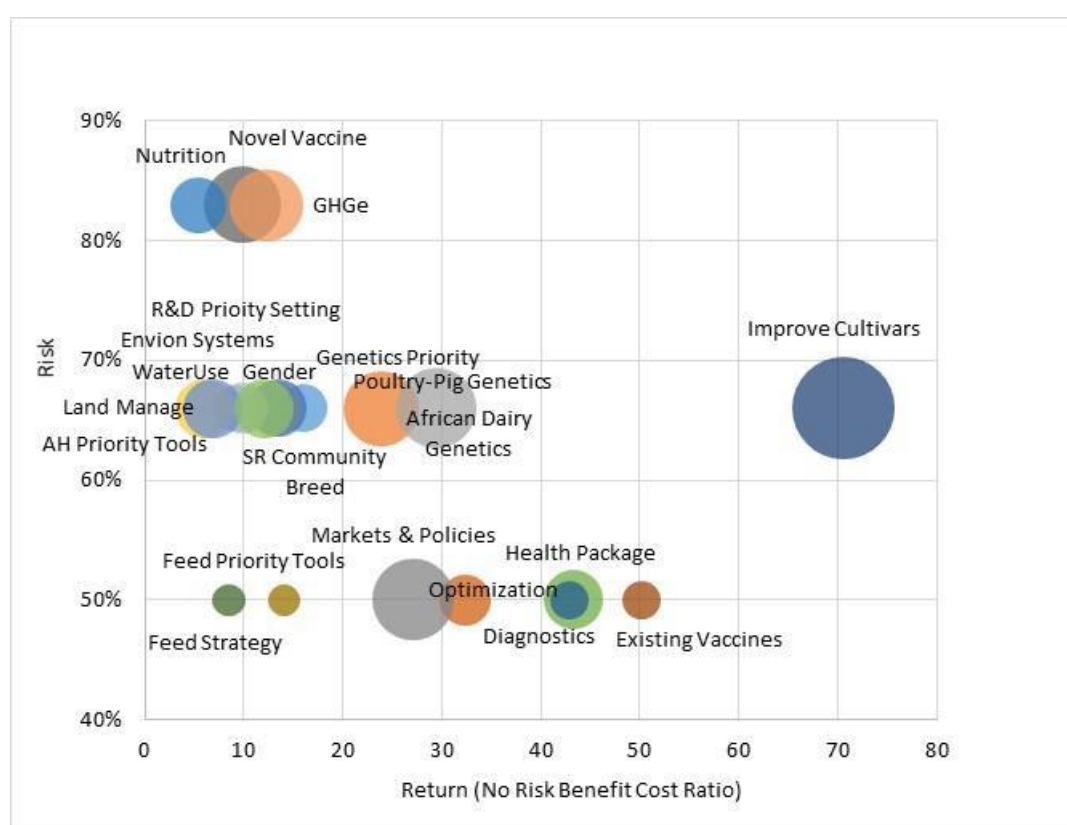
Economic payoff

Given the high weighting of economic returns in the composite index, along with the use of economic results in the poverty index and internationality calculations, the benefit-cost ratio has a large impact on calculated index values. Probabilities of success are of particular importance in economic return calculations. They were estimated for each stream using the benchmarks of the 1999 impact study and varied from a low probability of 17 percent to a high of 50 percent. The risk profile and risk-free economic payoff of each stream are outlined in the following figure. It is evident that streams are spread across low to medium risk. Streams such as nutrition, novel vaccines and GHGe are deemed to be higher risk streams, whereas tools, improved cultivars, markets and policies, and development of an

integrated herd health package are low-medium risk. The portfolio is relatively well structured for risk, with stream spread over three risk levels. More streams are categorised as having to low-medium or medium risk, when compared to higher risk. This suggests a conservative approach to managing risk. Less investment is devoted to higher risk upstream activities when compared to proof-of-concept, pilot and scale activities.

Higher return streams include development of existing vaccines, improved cultivars, poultry and pig genetic improvement, optimisation, integrated herd health, and markets and policies. In the case of cultivar development and poultry and pig genetics, a large productivity increase is included in the evaluation. It is estimated that the introduction of crossbred chickens and sowing of improved cultivars would increase the productivity of average animals among adopting farms by 15-20 percent. There is a high degree of uncertainty surrounding these parameters as no published trial or survey analysis, for example, has been conducted at scale for planted forages to provide evidence for estimation. If a productivity gain of 5 percent for improved planted forage cultivars were included, the stream would fall out of the top third of stream rankings by the composite index. Clearly there is a need to undertake research to gauge the magnitude of these farm productivity gains at scale. This is discussed in the further research section.

Figure 2: Economic Return and Risk for 21 Research Streams



Source: Calculations this study

Planning and priority setting streams were typically assigned an indirect productivity gain of 0.1 percent. Research across flagships was estimated to be positively impacted by these activities, therefore the impact was deemed to have a relatively broad footprint. This is reflected in adoption assumptions and in the internationality indices calculated for largely Cluster 1 activities. The breadth of

adoption positively offsets the lower productivity gain assumption, with most streams of this nature having middle of the range economic pay-offs.

Most research is deemed to have a lag of around 6 years before a product or practice is first used by farmers or other stakeholders. This is referred to as research lag, or the time between research commencing and a benefits being realised in the field through farmer adoption or policies being instituted. The development of novel vaccines is forecast to have the longest lag time. The lag is not compensated by wide-spread productivity impacts. Much of the research is targeting East Coast Fever. This disease has a very large impact on a relatively small number of cattle reared in East and Southern Africa. The potential pay-off, when coupled with a low probability for success, is not as substantial as other streams in the portfolio.

Livestock genetics and genomics research was found to fall in the lower half of the rankings in the 1999 impact assessment. This was because genetics research was deemed to be longer term – due to the long breeding cycles of ruminants and nature of genomics. Most of the streams in the CRP portfolio are more applied genetics research involving the introduction of cross-breeds. For example, poultry research involves the introduction of Indian crossbred strains into indigenous African breeds. Poultry have relatively quick generation times, therefore research lags are shorter than those for large ruminant using genomics evaluated in 1999. Small ruminant community breeding is estimated to have a modest benefit-cost ratio as the stream is mainly targeting small ruminant production in pockets of Africa. The potential for widespread adoption is limited due to the need to involve communities, which is costly and time consuming.

The ISPC recommends that CRPs accommodate a range of stages of the research pipeline, ranging from discovery research, proof of concept, pilot, and upscaling innovations demonstrated to work.⁵ A healthy pipeline was defined as one delivering a steady stream of innovations in the short to medium term, and at the same time investing in upstream research that will be the basis for innovations in the long term. The Livestock and Fish evaluation found the CRP could also do more to explore delivery pathways – which might include connections with the private sector. Field testing and delivery was noted as being on a very small scale and published outputs had not yet emerged or appear to be in the pipeline (CGIAR-IEA, 2016). The evaluation of Livestock and Fish noted that technology outputs of the CRP had been limited mainly because the key emphasis was on long-term research (e.g. development of new vaccines).

Flagships in the CRP proposal are typically structured with research to identify priorities and enhance tools, identify promising technologies through proof-of-concept and piloting, then take them to scale using Cluster 3 resources. The proposed CRP has been developed with a more balanced portfolio of research, giving greater emphasis to research streams that result in product and practices addressing a wider range of productivity problems. The length of these product or practice development pipelines varies according to the technologies being developed. Development outcomes are staggered with Flagship 5 streams delivering policy and farm productivity impacts in the shorter term, Flagship 3 cultivars and feeding strategies are relatively short term, while livestock health and genetics have a range of medium to longer term prospects.

Novel vaccines are an example of a longer term stream. The overall portfolio forecast mean benefit-cost ratio is 9. This compares relatively well with reviews of the impacts of CGIAR research. Raitzer and Kelley (2008), for example, found a benefit-cost ratio range of 9-17 for project economic evaluations with plausible designs and with some extrapolation. The ISPC highlights the need to manage the risks of running a pipeline dry to achieve short term results at the expense of discovery science, or to over-invest in discovery science. This risk appears to be well addressed in proposed CRP investments. Higher

⁵ Discovery (new concept of product), proof-of-concept (real world 1000s), pilot (multi-location 100 thousands) and scale-up (millions).

and lower risk investments have been balanced to achieve a sound economic return (e.g. benefit-cost ratio).

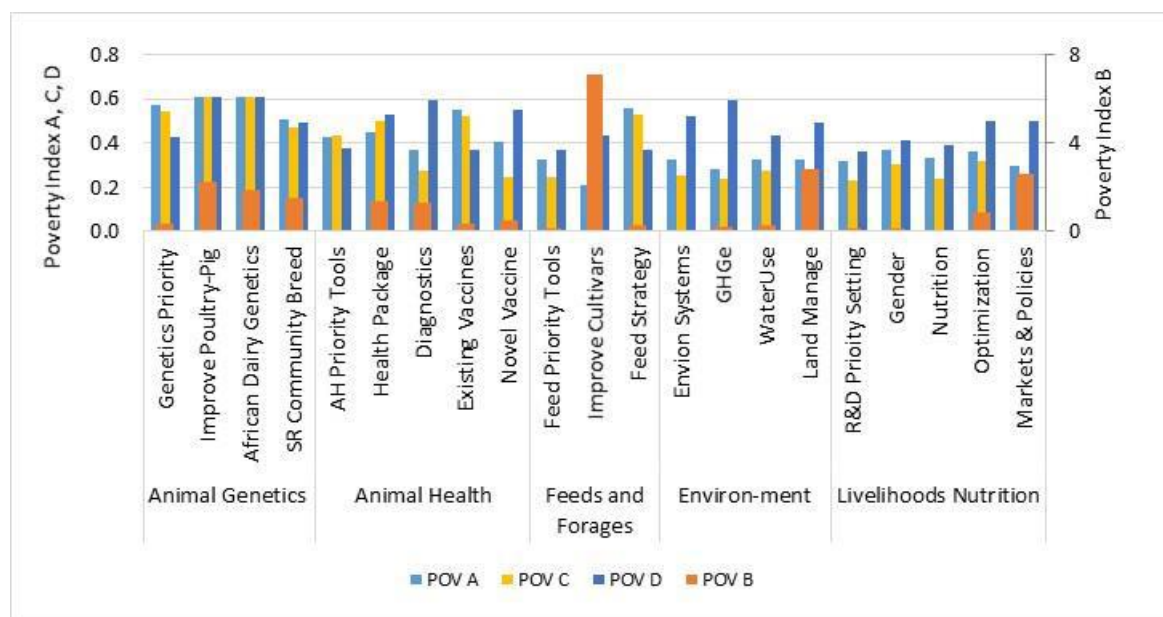
The evaluation of Livestock and Fish recommended that the CRP be streamlined into areas of greatest potential impact on IDOs taking into account scientific capacity and based on very clear decision criteria (CGIAR-IEA 2016). The evaluation recommends the need for a broad-based approach to donors and types of impacts, along with consideration being given to the overall balance of funds so critical mass of funds is provided to research streams giving them a reasonable chance of delivering a development outcome. Proposed resources are spread relatively evenly across themes in the portfolio. Livestock genetics and livestock livelihoods account for around half of W1/2 and bilateral expenditures, followed by livestock health and livestock feeds and forages, then livestock and the environment.

Each flagship has a stream which was ranked in the top third of all ranked streams in this impact assessment. No flagship seems to score dramatically less than others which suggests a sound thematic balance. Livestock Genetics and Health have the largest shares of W1/2 resources. Average expenditures proposed for clusters and their activities varies considerable. The development of cultivars for Latin America appears to be the largest W1/2 investment, while streams with the environmental flagship are at the lower end of stream investments. Flagships need to consider whether individual streams are funded to the degree to have development impact. This may entail further streamlining as the Livestock and Fish evaluation has suggested.

Poverty impact

The CGIAR SRF aims for 100 million more farm households to have adopted improved varieties, breeds or trees, with 30 million people (50% women) assisted to exit poverty. Geographic targeting is a large part of achieving this goal. Africa is earmarked for over 50% of investment, Asia around 30% of and poverty hotspots in Latin America about 20%. It is noted that many of the poor in these areas are predominately smallholder farmers, and that increased productivity may be an important pathway to poverty reduction if it leads to increased incomes. The impact framework captures these dimensions by relating estimated economic benefits on a regional basis to numbers of poor and the severity of poverty in target areas. Four indices were calculated in the 1999 impact study and are again used in the analysis of the proposed CRP. Results are outlined in the following figure and followed by a discussion of index calculation and implications for portfolio design.

Figure 3: Poverty Indices for 21 Research Streams



Source: Calculations this study

Poverty index A (POV A) is the estimated poverty severity indices calculated for each region weighted by maximum economic benefit calculated for each region. This index rewards research themes that focus their impact on regions and production systems with relatively more poverty. Poverty indices C and D also weight economic benefits by the severity of poverty, but do so considering the economic benefit per poor person in Index C (POV C) and number of poor people per \$ of economic benefit in the case of Index D (POV D). Poverty Index B (POV B) is the economic benefit generated per poor person in target production systems. It is estimated as the total expected economic benefit (in US dollars) from a research stream divided by the total number of poor present in the relevant regions and production systems.

Indices A, C and D are highest for animal genetics and the development of herd animal health packages. These streams focus directly on Africa where poverty severity is estimated to be most severe. Poverty severity is estimated to be 0.59 in Sub Saharan Africa, 0.38 in South Asia, 0.39 in East Asia and the Pacific and 0.22 in Latin America and the Latin America and Caribbean. Many of the livelihoods and environmental streams also include research in East Asia and the Pacific, therefore an overall lower poverty index is estimated. Economic benefits per poor person is highest for cultivar development. Relatively less numbers of poor reside in the Latin America target region. When the large economic benefits of cultivar development are related to these numbers of poor, Poverty Index B is estimated to have the highest value for this stream.

Calculation of poverty indices does not explicitly consider the notion of “by and for the poor”. The economic benefit calculations focus on valuing productivity benefits for producers. Although the economic model estimates consumer and producer surplus, the distribution of benefits by economic strata is not considered. Analysis of the distribution of productivity and efficiency benefits for various target value chains is required to determine who captures price and volume benefits, and the extent to which different groups may benefit from employment and more affordable animal source food. (for the poor) (CGIAR-IEA 2016). Despite the need for this analysis, broad brushed distribution of economic benefits by regions provides some indication of the potential for research streams to assist in poverty

reduction. It is evident that most CRP investment is targeting Africa, with flagships such as animal genetics and animal herd health packaging having high relative proportions of resource targeting this region.

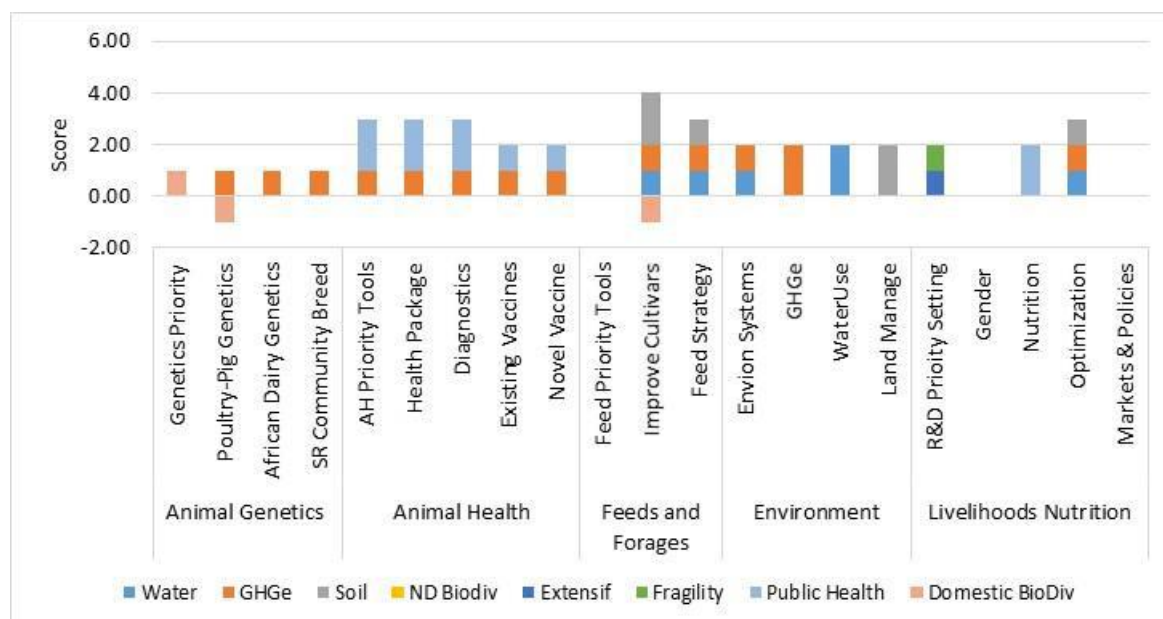
Environment

Environmental research is integrated across the proposed portfolio. Environmental assessments will be conducted as part of Cluster 1 activities of the Livestock and the Environment Flagship to minimise the footprint of livestock production, along with promoting the beneficial impacts of livestock on the environment. Specialised streams of research under Cluster 2 in this flagship will involve field research to provide context-specific solutions that minimize trade-offs between increasing productivity, enhancing ecosystem services, reducing environmental footprints, and adapting to expected environmental change. Cluster 3 will undertake policy and institutional research to take solutions to scale. The aim of the CRP's environmental lens is to minimise land, water and forest degradation, increase resilience of agro-ecosystems and communities and reduce net greenhouse gas

Research within flagship clusters was rated as having a strong positive to strong negative impact on soil and water resources, greenhouse gases, biodiversity, ecosystem fragility, extensification and public health. Scores are summarised by research stream in the above figure and a scorecard matrix included in tables 6 to 9. Scores are attributed to research streams as an average of the clusters they bridge. The Livestock Genetics flagship was perceived to have both positive and negative impacts on biodiversity. On one hand it is a repository of diverse genetic information, but widespread adoption of specific breeds could lead to a loss of domestic biodiversity in the case of poultry. Improved animal productivity would reduce greenhouse emissions for each unit of livestock production, therefore genetic gains scored positively on this criterion. Livestock health was considered to have public health benefits and improved animal productivity would also reduce greenhouse gas emissions.

Environmental research is integrated across the proposed portfolio. Environmental assessments will be conducted as part of Cluster 1 activities of the Livestock and the Environment Flagship to minimise the Livestock Feeds and Forages was scored as having water efficiency and greenhouse benefits. The evaluation of the Livestock and Fish CRP noted that breeding of *Brachiaria* for biological nitrification inhibition had made progress but will require several further well planned steps before it can contribute to greenhouse gas emission reductions at scale (CGIAR-IEA, 2016). Scale-up research planned in the proposed CRP should help progress delivery. A loss of biodiversity would be observed in the event improved cultivars gained large shares of areas planted to forages or full purpose crops. The Livestock and the Environment Flagship was scored positively across all clusters. Streams of work focussing on GHGe, water use and rangeland were differentially scored as strongly scored for each of these aspects of environmental impact.

Figure 4: Environmental Scores for 21 Research Streams



Source: Calculations this study

Environmental assessments which are to be integrated across the CRP were considered to minimise the chances of strong negative impacts. Unlike the 1999 impact assessment, only a small number of streams received negative ratings due to the widespread use of EIA. R&D priority setting and impact analysis was thought to have positive indirect impacts on ecosystems and extensification. The optimisation stream was scored as having GHGe, water use and soil benefits, while the nutrition stream strong public health benefits.

Capacity development

Capacity development (CapDev) is considered across each of the flagship clusters and mapped back to research streams. The clusters within each flagship in many instances align with discovery, proof-of-concept and scale research phases. The CRP proposal development guidance notes that the focus of capacity development activities will vary across phases, with scientific exchange programs or academic programs at discovery and a greater involvement of farmers, non-academic training for lab technicians and government official at proof of concept and scaling phases. Each of the proposed flagship clusters were scored using low, medium and high rating for contribution of research to capacity development Sub-IDs in order to capture the varied intensity and focus of capacity development across the portfolio.

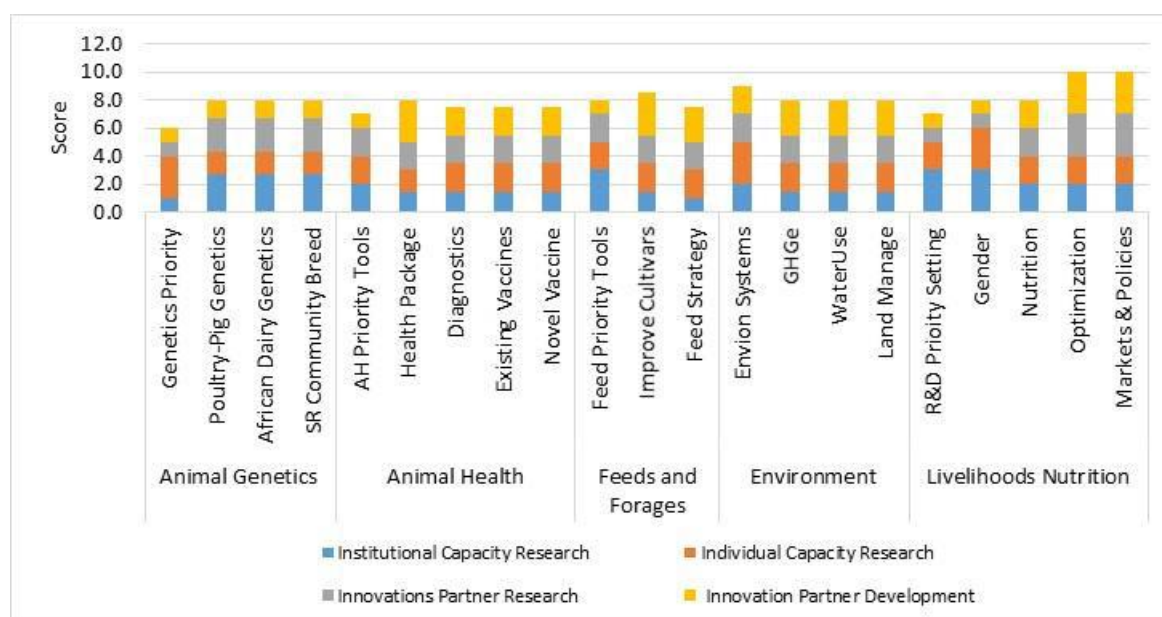
Results of the scoring are presented in the figure below for enhanced institutional capacity of partner research organizations, enhanced individual capacity in partner research organizations through training and exchange, increased capacity for innovations in partner research organizations and increased capacity for innovation in partner development organizations and in poor and vulnerable communities. Where streams bridge clusters, the average score across relevant clusters is attributed to the research stream. The stream by cluster scorecard matrix is presented in tables 6 to 9.

Scoring for overall capacity development (combining all four criteria) was particularly high for the Livestock Livelihoods and Agri-Food Systems Flagship. The flagship has a focus on innovation platforms, nutrition and gender, and scaling. The total scores for other flagships were similar, except for livestock feeds and forages. The rationale for these scores require clarification and verification of actual CapDev activities in the flagships, especially where bilateral projects are said to contain a large proportion of the CapDev activity. Variation was evident across sub-IDO themes.

Livestock Genetics has capacity development across each stream from characterization to delivery. Technical and management training will be provided to national institutes, along with collaboration with the BecA-ILRI Hub. The scoring of capacity development varies by cluster within the Livestock Health Flagship. Enhanced institutional capacity of partner research organizations was scored as medium for Cluster 1, as training in priority setting and planning for animal disease control will be provided. Some training will also be provided to farmers in the assessment and impact of diseases. This was scored as medium impact for the sub-IDO - enhanced individual capacity in partner research organizations, but low for sub-IDO - increased capacity for innovation in partner development organizations. Cluster 4 involves the improved delivery of services and training activities will be provided to development partners – including farmers – to support this objective. Cluster 2, which involves herd health package development, includes farmer and vet engagement and R4D activities. Cluster 3 CapDev activities involve MSc/PhD fellowships and more advanced partnerships around the BecA-ILRI Hub/ABCF.

Cluster 2 of the Livestock and the Environment Flagship was scored highly for enhanced individual capacity in partner research organizations, while Cluster 3 was scored highly for increased capacity for innovation in partner development organizations. An aim of Cluster 2 is resolving some of the environmental issues that livestock creates, so the involvement of environmental managers, staff of national agencies and the global research community is central to capacity development. Livestock Feeds and Forages capacity development in Clusters 1-2 was deemed to have a medium impact on enhanced individual capacity in partner research organizations due to the support for fellowships. Cluster 4 aims to improve scale-up and delivery through increased capacity for innovation in partner development organizations and scores highly for sub-IDO increased capacity for innovation in partner development organizations.

Figure 5: Capacity Development Scores for 21 Research Streams



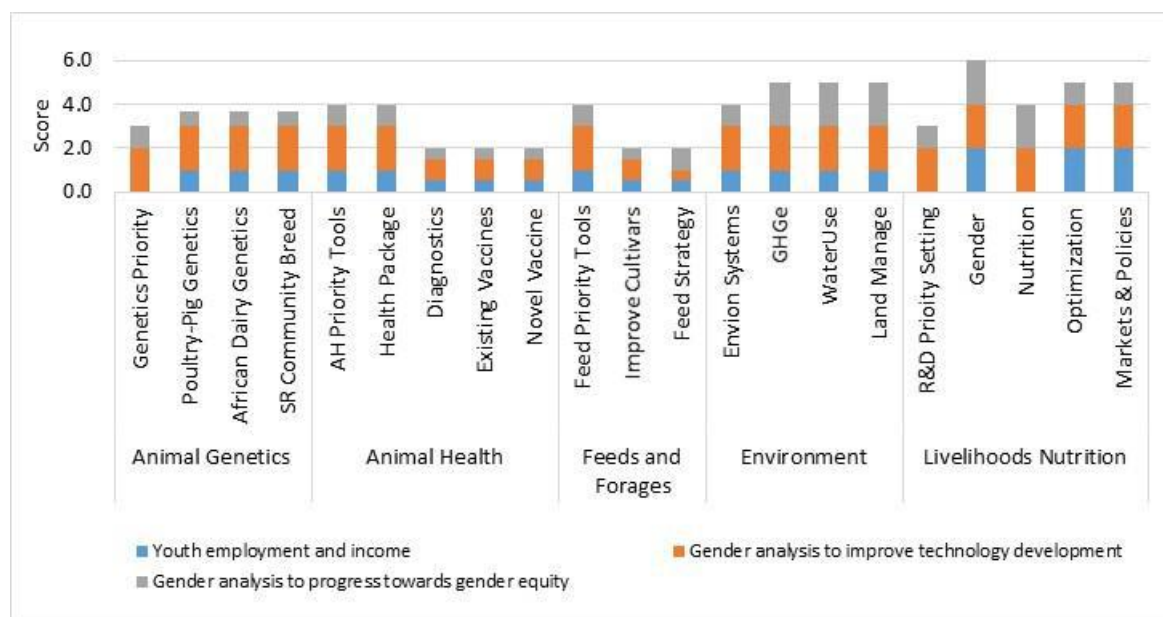
Source: Calculations this study

Inclusiveness

Inclusion was considered by scoring whether clusters were deemed to have an important, incidental or no impact on youth employment and income, gender analysis to improve technology development and gender analysis to progress towards gender equity. The second criteria focuses on analysis that considers specific constraints that women and men face, helps the development of interventions that support gender equality and meet poverty reduction and productivity objectives. The third focusses on gender transformative approaches which assess how women are integrated into agricultural development. Specific research on gender and social equity is a cluster within the Livestock Livelihoods and Agri-Food Systems (LAFS) flagship, while gender analysis has been integrated across all the flagships to varying degrees. Scores by research streams are outlined in the following figure. The complete scorecard by stream and cluster is presented in tables 6 to 9.

The Livestock and the Environment and the Livestock Livelihoods and Agri-Food Systems Flagships have the highest overall scores for inclusion. The gender cluster sits within the second of these flagships and many on-farm and scale up activities are pulled together amongst them. The Livestock Genetics Flagship will consider gender relations, dynamics and norms that affect species and breeds preferences that in turn affect the relevance of genetic improvement outputs and their adoption. The Livestock and Fish CRP gender strategy noted that gender disparities also are evident in the types of livestock women and men own, with women more likely to own small livestock than large livestock. This flagship will assess species and breed preferences in relation to gender norms, and factor in gender dimensions to genetic improvement approaches and delivery mechanisms. Gender dimensions in livestock health – such as preferences for vaccines and their utilization, impact of zoonosis on household health or access to veterinary services will be considered in the Livestock Health Flagship. Inclusion is scored highly in the development of animal health packages. Livestock feeds and forages will consider gender dynamics in the choice of forage systems and crop and forage species preferences. These dimensions will be factored into assessments that inform feeding option. Research into the roles of women and youth on the environment is integrated across the environmental flagship.

Figure 6: Inclusiveness Scores for 21 Research Streams

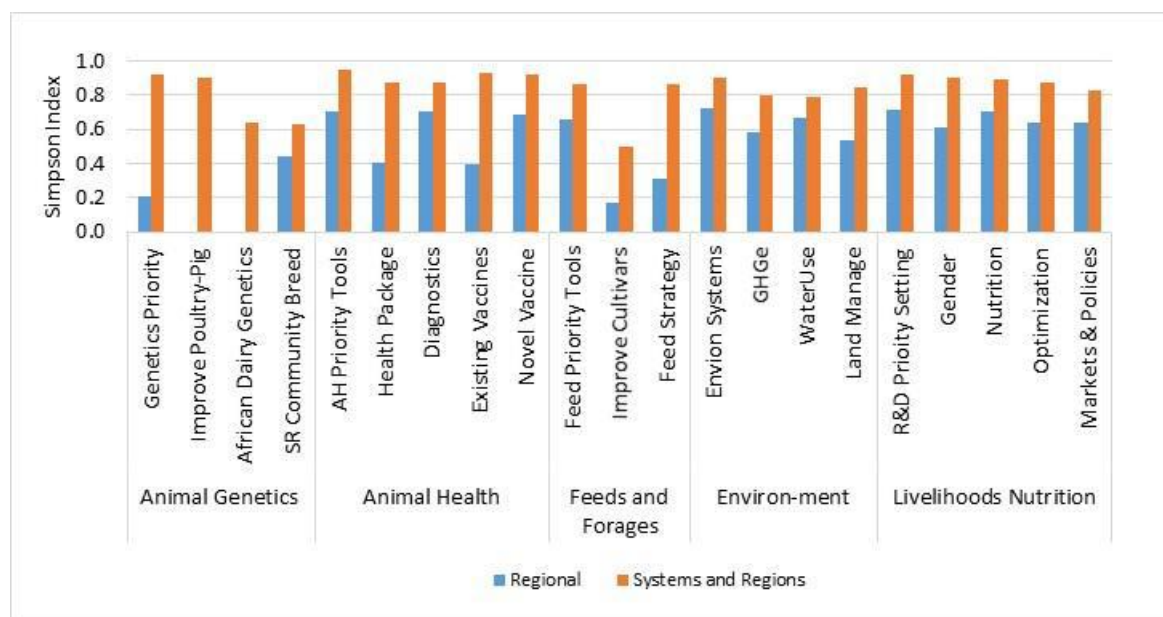


Source: Calculations this study

Internationality

The CGIAR results framework emphasises the need to deliver international public goods (IPGs). These public goods cross nations and regions, and Ryan (2006) considers their impacts are maximised if expected outputs are relevant to as many countries as possible (CGIAR-IEA, 2016). The 1999 impact approach uses the Simpson's Index of Dispersion to quantify the degree calculated economic benefits are spread. Two indexes were calculated. The first, a regional index, estimates spread of economic benefits across World Bank regions. The second calculates spread across regions and livestock systems. The two indices are presented in the following figure for the 21 proposed research streams. Much of the research in animal genetics is African centred, therefore a zero regional index is estimated for most of the genetics streams. Regional spread is greatest for the integrating flagships.

Figure 7: Internationality Scores for 21 Research Streams



Source: Calculations this study

Conclusions

The proposed Livestock Agri-Food Systems CRP has been quantitatively evaluated using scoring methods and economic surplus benefit-cost approaches. Research streams with higher expected economic impacts included poultry-pig genetics, existing vaccines, dairy genetics, on-farm optimisation and improved cultivars. Each flagship has a stream that was highly ranked. This suggests trade-offs between the various economic, poverty alleviation, environmental impact, internationality, capacity development and inclusiveness dimensions of research investment impacts have been balanced in portfolio resource allocation. The short time frame for the evaluation has not allowed a fully harmonized review of the parameter estimates. This will be undertaken in the future as part of on-going impact assessment activities. Notably, higher productivity assumptions for animal genetic improvement and cultivar development were included than the benchmarks used in the 1999 impact assessment (Thornton *et al.*, 1999). Although they are lower than those being simulated for yield gap estimation in the LiveGap Project (Herrero *et al.*, 2015) they are subject to uncertainty. The basic robustness of the results is most sensitive to assumptions about the probability of research and development impact success. Similar success estimates have been employed in evaluation of the proposed CRP to those in the previous impact assessment

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Table 6: Stream Ranking by Composite Index and Criteria. (1 highest, 21 lowest). Top 1/3 of stream for each criterion shaded dark blue

	Research Stream	Composite Score					Economic Pay-off					Internationality					Capacity Development					Inclusiveness					Environment					Poverty Index						
	Stream x Cluster	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5		
Livestock Genetics																																						
1	Genetics Priority	2 1					1 0					3					2 1					1 5					1 8					1 4						
2,3,4	Improve Poultry & Pig		6	6	6			8	8	8			8	8	8			1 2	1 2	1 2			1 2	1 2	1 2			1 7	1 7	1 7			1	1	1			
2,3,4	African Dairy Genetics		8	8	8			7	7	7			1 9	1 9	1 9			1 2	1 2	1 2			1 2	1 2	1 2			1 4	1 4	1 4			2	2	2			
2,3,4	SR Community Breed		1 5	1 5	1 5			1 2	1 2	1 2			2 0	2 0	2 0			1 2	1 2	1 2			1 2	1 2	1 2			1 4	1 4	1 4			1 1	1 1	1 1			
Livestock Health																																						
1	AH Priority Tools	1 7					1 1					1					1 9					8					9					1 7						
2,4	Health Package		2		2			3		3			1 2		1 2			5		5			8		8			9		9			6		6			
3,4	Diagnostics			3	3				4	4				1 1	1 1				1 5	1 5				1 7	1 7				9	9				3	3			
3,4	Exist Vaccines			1 0	1 0				1	1				2	2				1 5	1 5				1 7	1 7				1 2	1 2				1 9	1 9			
3,4	Novel Vaccine			1 3	1 3				2 0	2 0				4	4				1 5	1 5				1 7	1 7				1 2	1 2				5	5			
Livestock Feeds and Forages																																						
1	Feed Priority Tools	2 0					9					1 3					5					8					1 9					1 8						
2,4	Improve Cultivars		4		4			2		2			2 1		2 1			4		4			1 7		1 7			2		2			1 3		1 3			
3,4	Feed Strategy			1 8	1 8				1 3	1 3				1 4	1 4				1 5	1 5				2 1	2 1				3	3				2 0	2 0			
Livestock and the Environment																																						
1	Eviron Systems Analysis	9					1 6					6					3					8					5					7						
2,3	GHGe		7	7				1 8	1 8				1 7	1 7				5	5					2	2				5	5				4	4			
2,3	Water Use		1 2	1 2				1 5	1 5				1 8	1 8				5	5					2	2				5	5				1 2	1 2			
2,3	NRM Manage		1 1	1 1				1 9	1 9				1 5	1 5				5	5					2	2				5	5				1 0	1 0			
Livestock Livelihoods and Agri-Food Systems																																						

1	R&D Priority Setting	14				17					5				19				15				1				21						
2	Gender		16				14				7				5				1					19					15				
3	Nutrition			19				21				9				5				7					16					16			
4	Optimization				1				5				10				1				5				3					8			
5	Markets & Policies					5				6				16					1				5				19					9	

Table 7: Capacity Development Scorecard. (1 = low, 2= medium, 3 = high). High score shaded dark blue. Rk = ranking from 1-21, with 1 being the highest.

	Research Stream	Enhanced institutional capacity of partner research organizations						Enhanced individual capacity in partner research organizations through training and exchange						Increased capacity for innovations in partner research organizations						Increased capacity for innovation in partner development organizations and in poor and vulnerable communities					Combined Cap Dev Score (All Sub-IDOs)			
	Scoring by Stream X Cluster	1	2	3	4	5	Av	1	2	3	4	5	Av	1	2	3	4	5	Av	1	2	3	4	5	Av	To t	Rk	
Livestock Genetics																												
1	Genetics Priority	1					1.0	3					3.0	1					1.0	1						1.0	6.0	21
2,3,4	Improve Poultry & Pig		3	3	2		2.7		3	1	1		1.7		3	3	1		2.3		1	2	1			1.3	8.0	12
2,3,4	African Dairy Genetics		3	3	2		2.7		3	1	1		1.7		3	3	1		2.3		1	2	1			1.3	8.0	12
2,3,4	SR Community Breed		3	3	2		2.7		3	1	1		1.7		3	3	1		2.3		1	2	1			1.3	8.0	12
Livestock Health																												
1	AH Priority Tools	2					2.0	2					2.0	2					2.0	1						1.0	7.0	19
2,4	Health Package		2		1		1.5		2		1		1.5		2		2		2.0		3		3			3.0	8.0	5
3,4	Diagnostics			2	1		1.5			3	1		2.0			2	2		2.0			1	3			2.0	7.5	15
3,4	Exist Vaccines			2	1		1.5			3	1		2.0			2	2		2.0			1	3			2.0	7.5	15
3,4	Novel Vaccine			2	1		1.5			3	1		2.0			2	2		2.0			1	3			2.0	7.5	15
Livestock Feeds and Forages																												
1	Feed Priority Tools	3					3.0	2					2.0	2					2.0	1						1.0	8.0	5
2,4	Improve Cultivars		2		1		1.5		2		2		2.0		2		2		2.0		3		3			3.0	8.5	4
3,4	Feed Strategy			1	1		1.0			2	2		2.0			2	2		2.0			2	3			2.5	7.5	15
Livestock and the Environment																												

1	Systems Analysis	2				2.0	3				3.0	2				2.0	2				2.0	9.0	3
2,3	GHGE		2	1		1.5		3	1		2.0		2	2		2.0		2	3		2.5	8.0	5
2,3	WaterUse		2	1		1.5		3	1		2.0		2	2		2.0		2	3		2.5	8.0	5
2,3	NRM Manage		2	1		1.5		3	1		2.0		2	2		2.0		2	3		2.5	8.0	5
Livestock Livelihoods and Agri-Food Systems																							
1	R&D Priority Setting	3				3.0	2				2.0	1				1.0	1				1.0	7.0	19
2	Gender		3			3.0		3			3.0		1			1.0		1			1.0	8.0	5
3	Nutrition			2		2.0			2		2.0			2		2.0			2		2.0	8.0	5
4	Optimization				2	2.0				2	2.0				3	3.0				3	3.0	10	1
5	Markets & Policies				2	2.0					2	2.0				3	3.0			3	3.0	10	1
Portfolio Median						2.0					2.0					2.0					2.0	8.0	

Table 8: Inclusiveness Scorecard. Important score shaded dark blue

Flagship Clusters in Stream	Research Stream	Youth employment and income						Gender analysis to improve technology development						Gender analysis to progress towards gender equity					
	Scoring by Stream x Cluster	1	2	3	4	5	Av	1	2	3	4	5	Av	1	2	3	4	5	Av
Livestock Genetics																			
1	Genetics Priority	-					-	2					2.0	1					1.0
2,3,4	Improve Poultry & Pig		1	1			1.0		2	2	2		2.0		-	1	1		0.7
2,3,4	African Dairy Genetics		1	1			1.0		2	2	2		2.0		-	1	1		0.7
2,3,4	SR Community Breed		1	1			1.0		2	2	2		2.0		-	1	1		0.7
Livestock Health																			
1	AH Priority Tools	1					1.0	2					2.0	1					1.0
2,4	Health Package		1		1		1.0		2		2		2.0		1		1		1.0
3,4	Diagnostics			-	1		0.5			-	2		1.0			-	1		0.5
3,4	Exist Vaccines			-	1		0.5			-	2		1.0			-	1		0.5
3,4	Novel Vaccine			-	1		0.5			-	2		1.0			-	1		0.5
Livestock Feeds and Forages																			
1	Feed Priority Tools	1					1.0	2					2.0	1					1.0
2,4	Improve Cultivars		-		1		0.5		-		2		1.0		-		1		0.5
3,4	Feed Strategy			-	1		0.5			-	1		0.5			1	1		1.0
Livestock and the Environment																			
1	Systems Analysis	1					1.0	2					2.0	1					1.0
2,3	GHGE		1	1			1.0		2	2			2.0		2	2			2.0
2,3	WaterUse		1	1			1.0		2	2			2.0		2	2			2.0
2,3	NRM Manage		1	1			1.0		2	2			2.0		2	2			2.0
Livestock Livelihoods and Agri-Food Systems																			
1	R&D Priority Setting	-					-	2					2.0	1					1.0
2	Gender		2				2.0		2				2.0		2				2.0
3	Nutrition			-			-			2			2.0			2			2.0
4	Optimization				2		2.0				2		2.0				1		1.0
5	Markets & Policies					2	2.0					2	2.0					1	1.0
Portfolio Median							1.0						2.0						1.0

Table 9: Environmental Scorecard. (-2 to 2 strong negative to strong positive).

Flagship Clusters in Stream	Research Stream	Water Resources						Greenhouse Gases						Soil Resources					
	Scoring by Stream X Cluster	1	2	3	4	5	Av	1	2	3	4	5	Av	1	2	3	4	5	Av
Livestock Genetics																			
1	Genetics Priority	-					-	-					-	-					-
2,3,4	Improve Poultry & Pig		-	-	-		-		1	1	1		1.0		-	-	-		-
2,3,4	African Dairy Genetics		-	-	-		-		1	1	1		1.0		-	-	-		-
2,3,4	SR Community Breed		-		-		-		1	1	1		1.0		-	-	-		-
Livestock Health																			
1	AH Priority Tools	-					-	1					1.0	-					-
2,4	Health Package		-		-		-		1		1		1.0		-		-		-
3,4	Diagnostics			-	-		-			1	1		1.0			-	-		-
3,4	Exist Vaccines			-	-		-			1	1		1.0			-	-		-
3,4	Novel Vaccine			-	-		-			1	1		1.0			-	-		-
Livestock and Forages																			
1	Feed Priority Tools	-					-	-					-	-					-
2,4	Improve Cultivars		1		1		1.0		1		1		1.0		2		2		2.0
3,4	Feed Strategy			1	1		1.0			1	1		1.0			1	1		1.0
Livestock and the Environment																			
1	Systems Analysis	1					1.0	1					1.0						-
2,3	GHGE		-	-			-		2	2			2.0		-	-			-
2,3	WaterUse		2	2			2.0		-	-			-		-	-			-
2,3	NRM Manage		-	-			-		-	-			-		2	2			2.0
Livestock Livelihoods and Agri-Food Systems																			
1	R&D Priority Setting	-					-	-					-	-					-
2	Gender		-				-		-				-		-				-
3	Nutrition			-			-			-			-			-			-
4	Optimization				1		1.0				1		1.0				1		1.0
5	Markets & Policies					-	-					-	-					-	-
								-						1.0					

(Cont)

Flagship Clusters in Stream	Research Stream	Non-Domestic Biodiversity						Extensification						Fragility of Ecosystems						Public Health						Domestic Biodiversity					
	Scoring by Stream x Cluster	1	2	3	4	5	Av	1	2	3	4	5	Av	1	2	3	4	5	Av	1	2	3	4	5	Av	1	2	3	4	5	Av
Livestock Genetics																															
1	Genetics Priority	-					-	-					-	-					-	-					-	1					1.0
2,3,4	Improve Poultry & Pig		-	-	-		-		-	-	-		-		-	-	-		-		-	-	-		-	(1)	(1)	(1)		(1.0)	
2,3,4	African Dairy Genetics		-	-	-		-		-	-	-		-		-	-	-		-		-	-	-		-	-	-	-		-	
2,3,4	SR Community Breed		-	-			-		-	-	-		-		-	-	-		-		-	-	-		-	-	-	-		-	
Livestock Health																															
1	AH Priority Tools	-					-	-					-	-					-	2					2.0	-					-
2,4	Health Package		-		-		-		-		-		-		-		-		-	2			2		2.0	-			-		-
3,4	Diagnostics			-	-		-			-	-		-			-	-		-			2	2		2.0			-	-		-
3,4	Exist Vaccines			-	-		-			-	-		-			-	-		-			1	1		1.0			-	-		-
3,4	Novel Vaccine			-	-		-			-	-		-			-	-		-			1	1		1.0			-	-		-
Livestock Feeds and Forages																															
1	Feed Priority Tools	-					-	-					-	-					-	-					-	-					-
2,4	Improve Cultivars		-		-		-		-		-		-		-		-		-		-		-		-	(1)		(1)		(1.0)	
3,4	Feed Strategy			-	-		-			-	-		-			-	-		-			-	-		-			-	-		-
Livestock and the Environment																															
1	Systems Analysis	-					-	-					-	-					-	-					-	-					-
2,3	GHGE		-	-			-		-	-			-		-	-			-		-	-		-		-	-				-
2,3	WaterUse		-	-			-		-	-			-		-	-			-		-	-		-		-	-				-
2,3	NRM Manage		-	-			-		-	-			-		-	-			-		-	-		-		-	-				-
Livestock Livelihoods and Agri-Food Systems																															
1	R&D Priority Setting	-					-	1					1.0	1					1.0	-					-	-					-
2	Gender		-				-		-				-		-				-		-				-		-				-
3	Nutrition			-			-			-			-			-			-			2			2.0			-			-
4	Optimization				-		-				-		-				-		-				-		-				-		-
5	Markets & Policies					-	-					-	-					-	-					-	-					-	-
								-						-					-							-					

Annex 3.10.3 Methodology for setting targets

To obtain the 2022 outcome targets for the CRP, at flagship level and as contributions to SLOs (PIM Table A) the Livestock CRP has taken a mixed-method approach to estimations. The methodology relies on expert-knowledge estimates of expected form and quantity of change (e.g. % productivity increase) combined with quantitative assessment of the target population that will be reached by 2022 using geographical adoption domains and beneficiary groups. Additional evidence of yield gain estimates is provided in the Animal Health and Animal Genetics flagships responses to the ISPC June 2016 commentary.

The assessment includes all Livestock CRP priority countries and other locations where flagships will work over the next 6 years (Section 1.0.7). The exercise was carried out in parallel with the ex-ante impact assessment exercise (Annex 3.10.2) and aimed to capture the synergies in specific key parameters for adoption domains and rates.

The 2022 outcome targets rely on many partnerships and how they are expected to be achieved, is the essence of the program's theory of change (Section 1.0.2). Further, the CRP recognises the importance of its specific targets for cross-cutting sub-IDOs, in particular gender, and how these will also contribute to achieving sub-IDO targets. It also highlights the importance of mobilization of large-scale development-focused projects that take its technologies to scale, with current evidence and projects indicating this is realistic.

For each Flagship Outcome: the geographical reach (country and livestock production system), the target population type (e.g. poor population, rural population, livestock keepers etc.), the livestock species, where relevant, and an estimate of level of reach (e.g. 10%, actual number from current bilateral projects, etc.) were combined to provide the overall targets.

These targets were then aggregated up to sub-IDO level (i.e. combined across Flagships working towards the same sub-IDO) and then mapped to SRF targets (Table 1.1 in Section 1.0.2). Indicators for sub-IDO outcomes were defined by the CRP, taking into account both the intuitive choice and the unit required to map each sub-IDO to the list of SRF targets; while recognising that the SRF target list is not exhaustive. The SRF target 2.1 for yield increases is designed for single crop commodity data entry into PIM Table A; an average increase is given in Table A and the table at the end of this annex details the country by species productivity and genetic gain increases in detail.

Details of the data used, their sources and relevant calculations are provided in the table below. The term 'poor livestock keepers' technically means, 'number of poor people living in livestock keeping households'. It should also be noted that the livestock production systems used were principally designed for ruminant animals.

There have been recent developments in the mapping of monogastric animals by intensity of production but these data were not available at the time of target-setting; selection of appropriate livestock production systems in countries where pig populations are known to be higher has minimised this problem.

For chickens the poor rural population layer was used, combined with appropriate production system, since the majority of households keep chickens.

The common CGIAR poverty threshold used in the first phase of the CRPs was USD 1.25 per person per day; however, the CRP decided to use the more updated World Development Indicators (WDI) "poverty headcount ratio at USD 1.90 a day" which is the percentage of the population living on less than USD 1.90 a day at 2011 international prices, as the more appropriate level to use for this target-setting exercise. Where countries were missing the WDI poverty percentage a regression of poverty versus GDP per capita PPP was used to interpolate these values.

Variable	Abbrev.	Unit / Calculation	Data & Source	Comments
Livestock Production Systems*	prodsys	Categorisation of all land area into 14 types of production system	All target populations as described below were assessed within each production system; hyperarid and arid combined. Robinson, T.P. <i>et al.</i> , 2011	
Human population*(total)	humanpop	Number	WorldPop	http://www.worldpop.org.uk/ - general link
% Urbanisation	Urban	% urban / km ²	Global Land Cover-SHARE of year 2014 - Beta-Release 1.0.	Global Land Cover Network ; urban category = artificial surfaces
Rural population*	ruralpop	(1-urban)*humanpop	Calculated variable	
Land Area	Area	km ² (1 km ² = 100 hectares)	Robinson, T.P. <i>et al.</i> , 2011; Linard, C. <i>et al.</i> , 2012	
GDP per capita PPP	Gdp	constant USD (\$)	World Development Indicators	Poverty set to zero for WorldBank high income countries; Provides the most recent value for the period 2011 - 2015
Poverty headcount ratio at \$1.90 a day (2011 PPP) (%)	Pov	% of population	World Development Indicators	Missing poverty rates were interpolated from a regression of GDP vs. Poverty rate for non-missing
Poor population < \$1.90 a day*	poorpop	humanpop*pov	Calculated variable	Some countries (mainly islands) with missing poverty rate
Poor rural population < \$1.90 a day*	poorurpop	ruralpop*pov	Calculated variable	
Livestock Distribution Pattern	Ldp	% (per livestock production system)	% of population living in livestock keeping households Robinson, T.P. <i>et al.</i> , 2011	
Poor livestock keepers (<\$1.90)*	poorlivekp	ruralpop*ldp*pov	Calculated variable	Number of poor people living in livestock keeping households
Fertility rate, total (births per woman)	fert rate	Number	World Development Indicators	
Average household size	aveHHsize	Average number	Multiple sources - UN, WorldBank, Wikipedia	Missing average households size were interpolated from a regression of Fertility rate vs. Average households size for non-missing
Number of households*	HH	humanpop/aveHHsize	Calculated variable	
Poor rural households (<\$1.90)*	PoorRHH	ruralpop/aveHHsize	Calculated variable	
Poor livestock keeping households (<\$1.90)*	PoorHH19	poorlivekp/aveHHsize	Calculated variable	

* See maps provided below

Key assumptions made at the flagship level were:

- Target population for each sub-IDO was treated independently (e.g. if reach 1,000 households for sub-IDO on “closing the yield gap” and 1,000 households for sub-IDO on “genetic gain” reflected as 1,000 in each of the two Flagship Outcome statements;
- Include potential spill-over effect from direct beneficiaries to indirect, taken as 1:2 for technology adoption and 1:3 for livelihood opportunities outcomes, respectively;
- To calculate the number of women for gender cross-cutting sub-IDO’s multiply the people by 0.2, 0.3 or 0.5 if cattle, small ruminants and pig or chicken systems, respectively. This was to take into account the differing role of women in production of different species.
- Peri-urban livestock keepers are captured under the number of rural livestock keepers population, because of the use of the global layer applied to estimate urban, and hence, rural population (see table above, Urban population variable)
- Policy uptake applied to poor livestock keepers, will under-estimate the number because it may miss some of the mono-gastric and poultry keepers but mitigated this with slightly higher adoption rate.
- Estimations of poor consumer numbers, for sub-IDO on reduced biological and chemical hazards in the food system include poor livestock keepers but are also reported as being impacted as keepers. The percentage of consumers reached is kept low to mitigate this potential double-counting.
- Numbers of people, or households, for different species in the same production system were counted independently; unless the species were goat AND sheep and then the cumulative total numbers of people, or households, was multiplied by 0.75.

Key assumptions made when aggregating up to sub-IDO level were:

- For the same sub-IDO, where different flagships work within the same target population assume beneficiaries are the same, i.e. no double-counting.

Key assumptions made when aggregating up to SRF target level were:

- For different sub-IDOs that contribute to the same SRF target, when aggregating to SLO level account for overlap of target population between sub-IDOs, both within and between Flagships, by:
 - taking the maximum only if country x species (where applicable) x production system x type of beneficiary is the same;
 - taking the maximum plus X%* of others if country x species (where applicable) is the same.
- For the SRF target on GHG emissions, livestock may be expected to contribute 70% towards total emissions; the 2022 SRF target is a reduction of 5%; given expected levels of funding and complexities of the system the CRP has assumed it can contribute 40% towards this reduction.
- To aggregate country by species by flagship yield gains up to SLO 2.1 level the priority species (1 or more) were used rather than all species, see table at end of annex.
- To translate increased incomes to numbers of people “exiting poverty” (SLO 1.2) there is need to consider the following: current levels of poverty (headcount and gap) and the distribution of these across livestock keepers, the relative importance of each species to household incomes in a given production system and the target increases provided for the relevant sub-IDOs (*Increased livelihood opportunities, Increased household capacity to cope with shocks, Reduced market barriers and More efficient use of inputs*⁺). A summary table highlighting these considerations, supporting evidence and the updated target figures for SLO 1.2 is provided below.

* The X% was approximately proportional to the overlap in production systems and/or type of beneficiary.

⁺ Note that double-counting of beneficiaries across the 4 sub-IDO was already removed prior to the figures provided below.

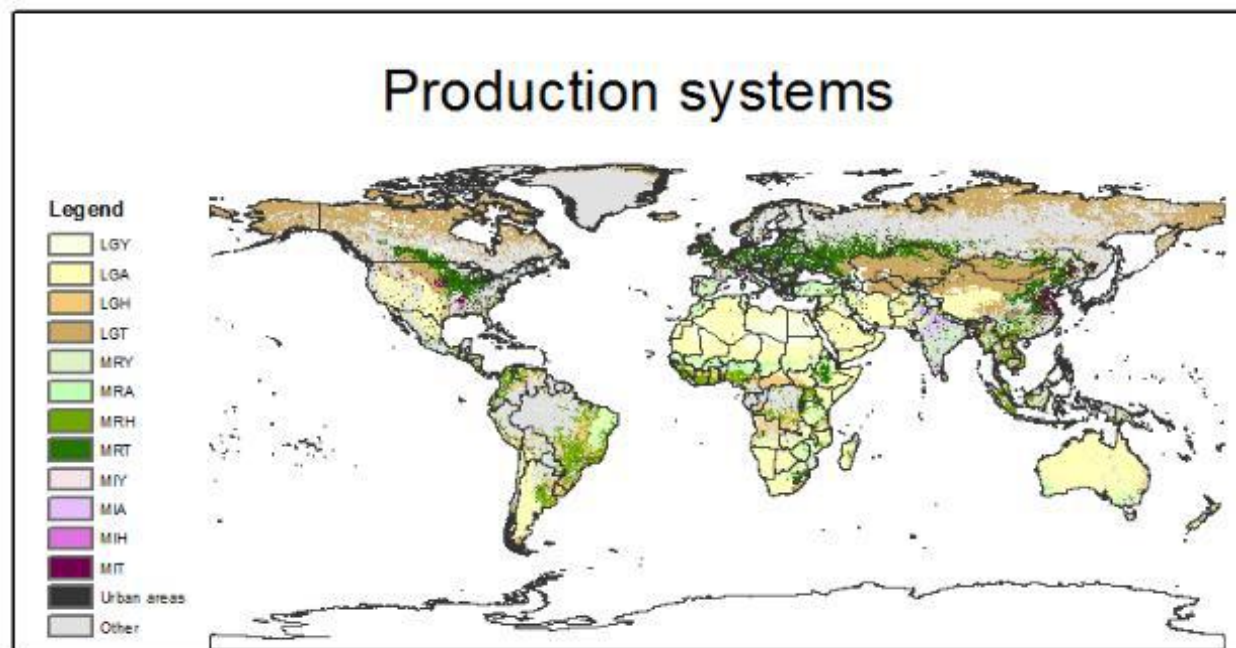
Translation of Income increase to “Numbers of people exited poverty” (SLO 1.2):

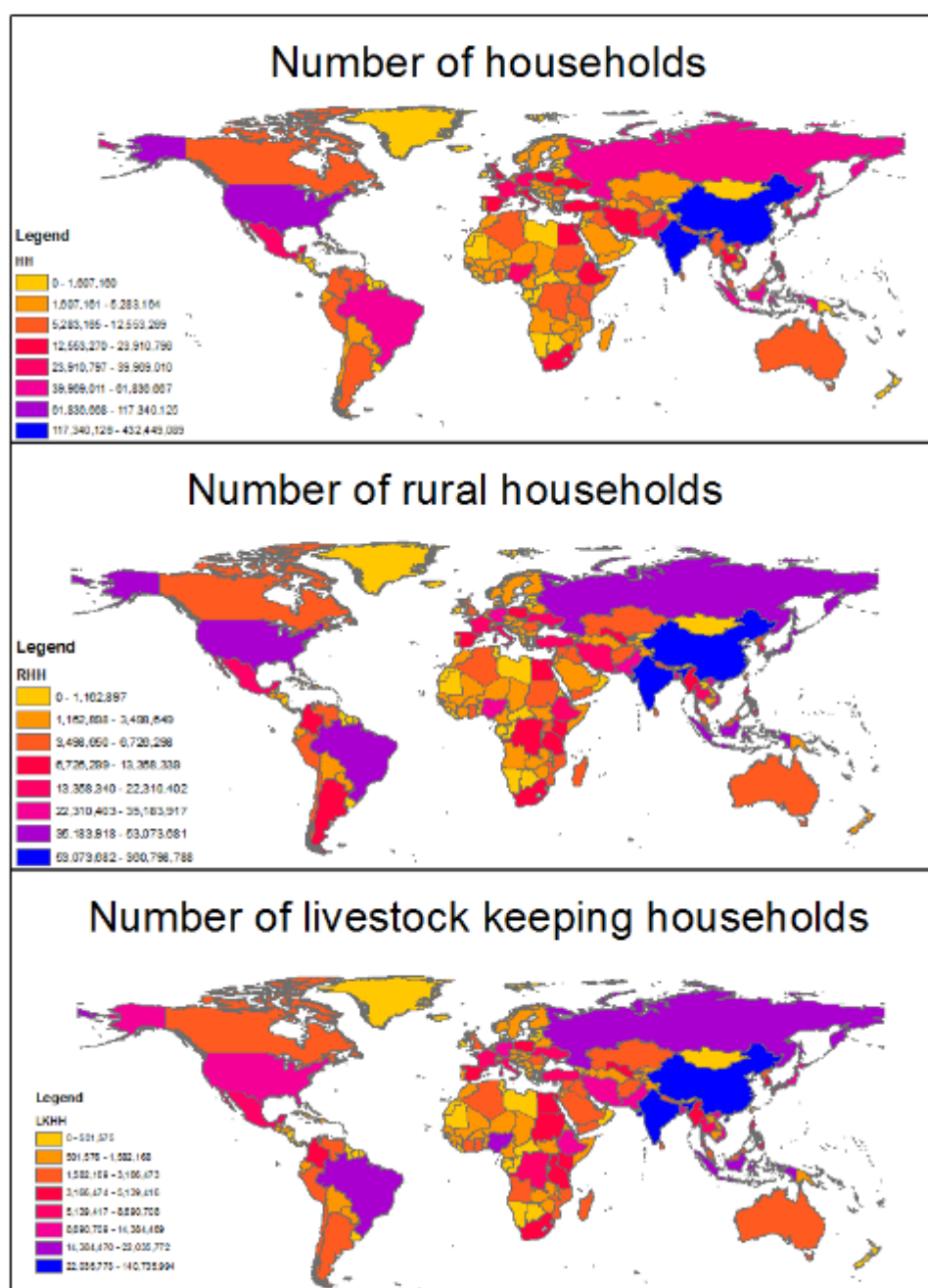
Country	Species ¹	Sub-IDO ²	Target numbers of people by sub-IDO ³	Poverty headcount ratio (%) ⁴	Poverty gap (%) ⁵	Average contribution of species to overall household income (%) ⁶	Target population average income increase (%) ⁷	Minimum USD for “lifting out of poverty”	Estimated % poor people with USD 1.5 – 1.9 / day ⁸	Number people raised out of poverty (SLO 1.2) ⁹
Bangladesh	Cattle	MEUI	512,767			60	12	1.70		232,256
	S. Ruminant	MEUI	191,629			30	6	1.79		45,856
Bangladesh Total			704,396	44	11				89	278,112
Colombia	Cattle	MEUI	39,694			60	12	1.70		19,798
Colombia Total			39,694	6	2.5				98	19,798
Ethiopia	Cattle	ILO	0			60	18	1.61		366,168
	Ruminant	MEUI	0			40	8	1.76		168,627
	Chicken	ILO	2,521,010			10	3	1.84		317,391
	SR	IHCS	635,646			30	1.5	1.87		12,680
		ILO	635,646			40	6 - 12	1.70 – 1.79		154,845
		RMB	635,646			30	1.5	1.87		12,680
Ethiopia Total			4,427,948	34	9				91	1,032,391
India	Cattle	MEUI	1,107,312			70	14	1.67		620,095
	S. Ruminant	MEUI	871,735			40	8	1.76		294,453
India Total			1,979,047	21	4.3				96	914,548
Kenya	Cattle	IHCS	218,887			60	3	1.84		20,279
		ILO	131,332			60	9	1.74		27,270
		MEUI	0			60	12	1.70		117,163
		RMB	145,925			60	3	1.84		11,397
	Ruminant	ILO	144,445			40	6	1.79		21,797
		RMB	144,445			40	2	1.86		7,551
Kenya Total			785,034	31	11.7				88	205,457
Nicaragua	Cattle	ILO	9,451			60	9	1.74		3,559
		MEUI	0			60	12	1.70		8,862
		RMB	9,451			60	3	1.84		1,256
Nicaragua Total			18,902	11	3.6				96	13,677

Country	Species ¹	Sub-IDO ²	Target numbers of people by sub-IDO ³	Poverty headcount ratio (%) ⁴	Poverty gap (%) ⁵	Average contribution of species to overall household income (%) ⁶	Target population average income increase (%) ⁷	Minimum USD for “lifting out of poverty”	Estimated % poor people with USD 1.5 – 1.9 / day ⁸	Number people raised out of poverty (SLO 1.2) ⁹
Nigeria	Cattle	MEUI	210,737			60	12	1.70		83,656
	Chicken	ILO	2,539,839			10	3	1.84		274,081
	S. Ruminant	MEUI	281,810			30	6	1.79		59,101
Nigeria Total			3,032,386	53	21.8				78	416,838
Pakistan	Cattle	ILO	112,411			60	9	1.74		43,647
	S. Ruminant	ILO	112,411			30	4.5	1.82		22,764
Pakistan Total			224,822	8	1.2				99	66,411
Rest of the world*	All	MEUI	1,933,862			5	1	1.88		87,311
Rest of the world* Total			1,933,862	13	3.7				96	87,311
Tunisia	SR	MEUI	60,833			40	8	1.76		21,191
Tunisia Total			60,833	2	0.4				99	21,191
Uganda	Cattle	MEUI	286,811			60	12	1.70		131,370
	Pig	ILO	433,702			30	4.5 - 9	1.74 – 1.82		110,020
		MEUI	57,362			30	6	1.79		13,881
		RMB	433,702			30	1.5	1.87		23,747
Uganda Total			1,211,577	33	10.1				90	279,018
Tanzania	Cattle	IHCS	299,835			60	3	1.84		11,707
		ILO	299,835			60	9 – 18	1.61 – 1.74		234,256
		MEUI	0			60	12	1.70		118,697
		RMB	299,835			60	3	1.84		11,707
	Chicken	ILO	2,290,199			10	3	1.84		269,321
Tanzania Total			3,189,704	47	14.4				85	645,688
Viet Nam	Cattle	MEUI	152,494			70	14	1.67		88,066
	Pig	ILO	60,473			30	4.5 - 9	1.74 – 1.82		22,016
		MEUI	138,798			30	6	1.79		36,946
		RMB	7,888			30	1.5	1.87		549
Viet Nam Total			359,653	3	0.6				99	147,577
Overall			17,967,858							4,128,017

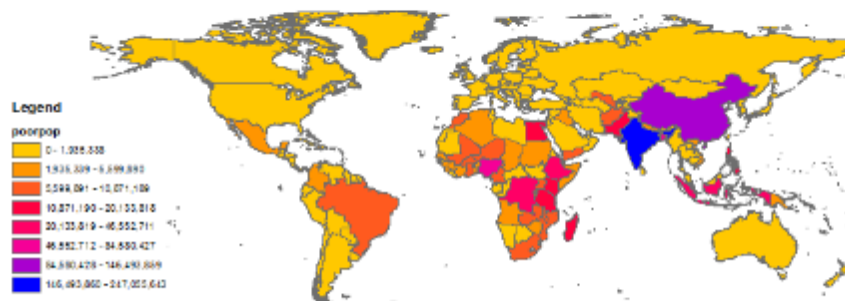
Coding for table above:

1. S. Ruminant = small ruminant, Ruminant = large & small ruminants, Chicken = Poultry - chicken
2. Increase livelihood opportunities (ILO), More efficient use of inputs (MEUI), Reduced market barriers (RMB), Increased household capacity to cope with shocks (IHCS)
3. Double-country across flagships and sub-IDO already removed
4. Poverty headcount ratio at \$1.90 a day (2011 PPP) (%) [World Development Indicators](#)
5. Poverty gap at \$1.90 a day (2011 PPP) [World Development Indicators](#)
6. Using various references – list in Staal et al (2009)
7. Using household level figures for income (but assuming all members of the household equally raised out of poverty)
8. Used a combination of the poverty gap (translated to USD) and assuming a moderate right-skewed distribution to estimate the percentage
9. Combining minimum USD for raising out of poverty and percentage of people between this level and \$1.90 to estimate number of total number of people exiting poverty, relative to the target number of people experiencing increase in income.

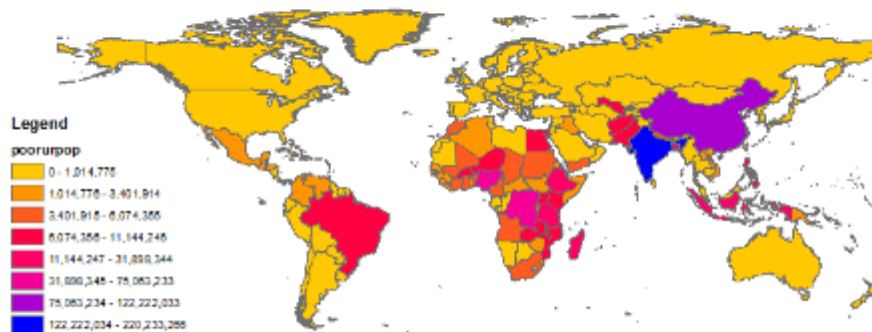




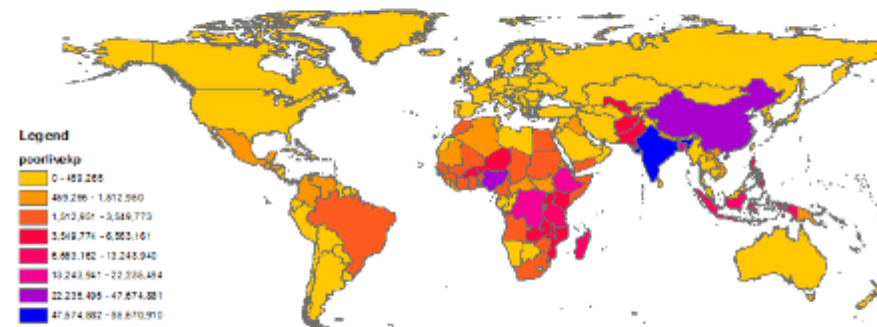
population below 1.9 usd/ day



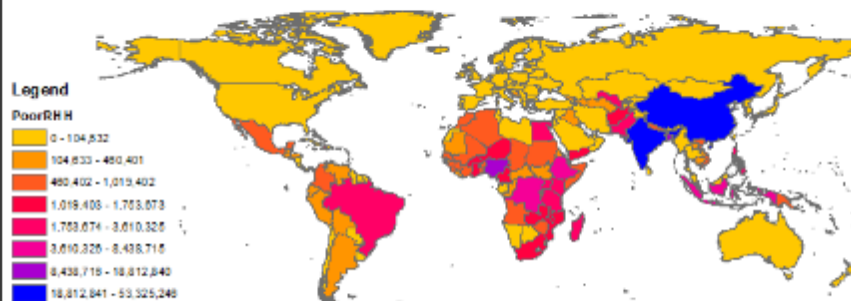
rural population below 1.9 usd/ day



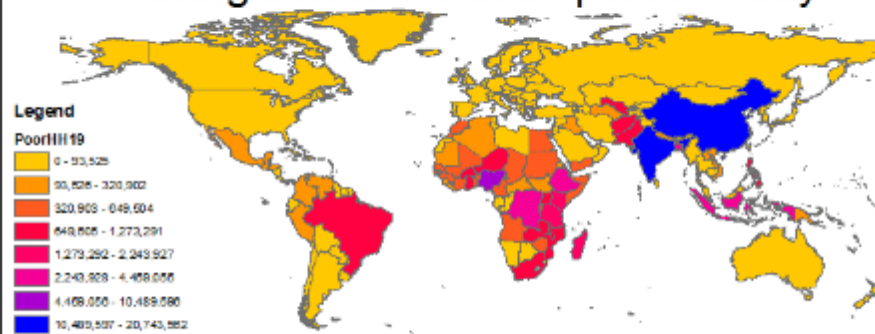
livestock keeper below 1.9 usd/ day

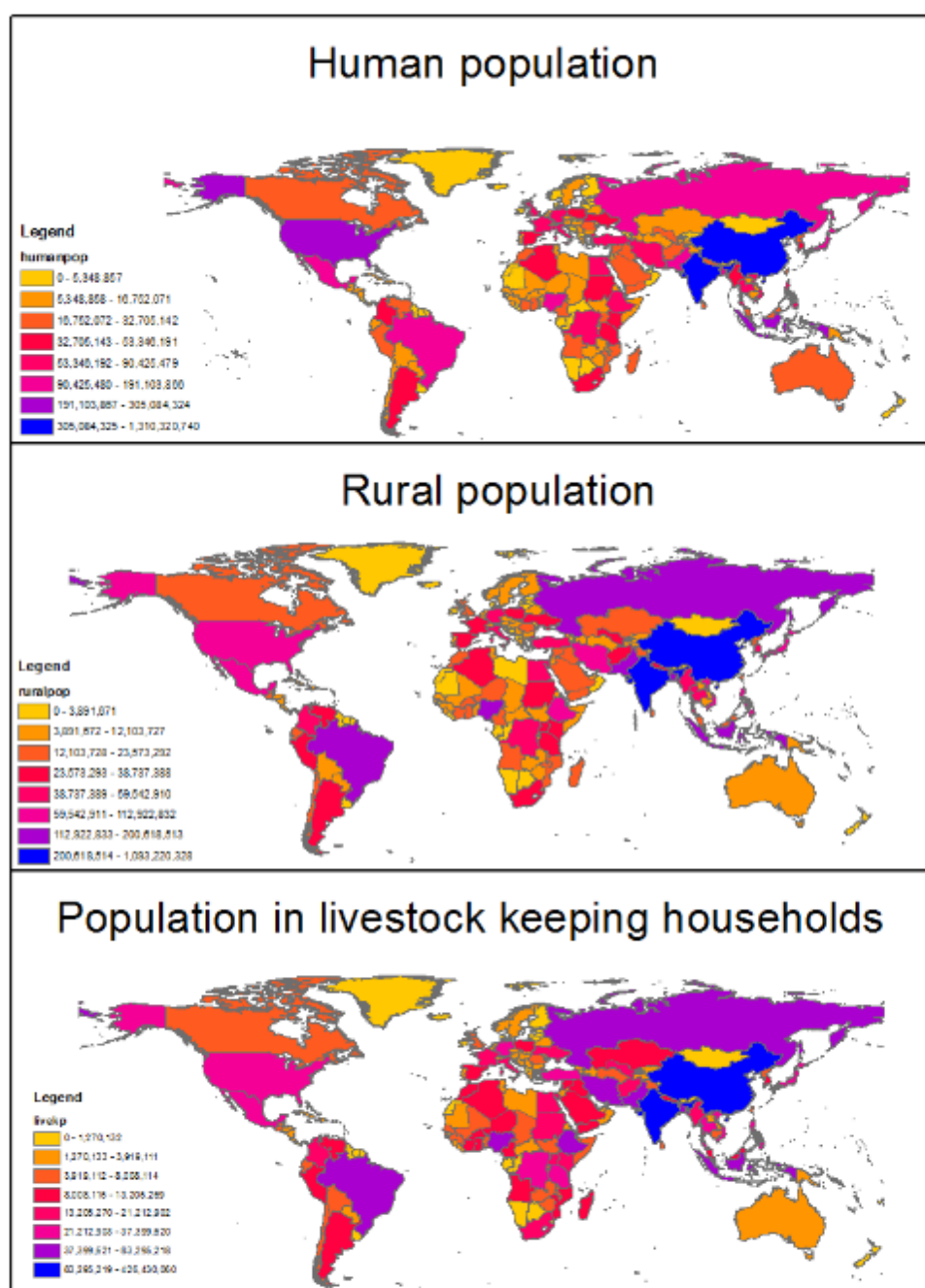


Number of rural households living below 1.9 usd / person / day



Number of poor livestock keeping households living below 1.9 usd / person / day





Detailed breakdown of percentage increases for SRF Target on Yield (SLO 2.1) – revised for 31 July 2016 submission

(% increase in 6 years)		Productivity			Genetic Gain
Country	Livestock species	Genetics	Health	Feed & Forages	Genetics ⁺
Bangladesh	Cattle - dairy*			30	
	Small ruminants*			30	
Burkina Faso	Ruminant - all*		3		
Colombia	Cattle - all*			30	
Ethiopia	Cattle - dairy*	20	10		50
	Poultry - chicken*	20			50
	Ruminant - all*			30	
	Small ruminants*	5	10		6
India	Cattle - dairy*		5	30	
	Small ruminants			30	
Kenya	Cattle - all*			30	
	Ruminant - all*		10		
Mali	Ruminant - all*		3		
	Small ruminants*			30	
Nicaragua	Cattle - all*			30	
	Ruminant - all*		5		
Nigeria	Cattle - all*			30	
	Goat			30	
	Poultry - chicken*	20			50
Rest of the world*	Not applicable*			30	
Tunisia	Small ruminants*			30	
Uganda	Cattle - all			30	
	Pig*	20	10	30	25
United Republic of Tanzania	Cattle - all*			50	
	Cattle - dairy*	20	10		50
	Poultry - chicken	20			50
Viet Nam	Cattle - all			30	
	Pig*	20	5	30	25
Overall average:		20%			35%

**Priority species figures used in aggregating to country level increase for PIM Table A*

** Lower threshold used for target-setting*

Annex 3.10.4 Stakeholder and partner consultations

During the final drafting process in February and March 2016, the program and its partners organized several face and online consultations to solicit inputs to the proposal development. Face to face meetings were held in Ethiopia, Kenya, Tanzania and Uganda and by ILRI and KIT (with their staff). Some 200 people representing research, government, universities, investors, and development partners joined these, discussing and providing inputs on the program's proposed focus, including the smallholder emphasis, the guiding trajectories, the science agenda, and key elements to deliver the Program (partnerships, gender, capacity development, uptake, etc.).

Alongside the face to face discussions, an [online space](#) was set up posing the same questions for feedback. More than sixty comments were provided. Core program partners further participated in 7 CGIAR country/site integration meetings to engage with national and other partners as part of the wider GCARD process.

This Annex presents feedback from the various discussions, organized around the key questions. It should be noted that the in-country discussions focused on the relevance of the proposal for that country's situation, so much feedback was very specific. What is presented here is mainly the bullet points documented during the discussion. The notes from the online part comprise more complete sets of comments and suggestions, some short, some quite lengthy. The notes and contributions are preceded by a synthesis of insights emerging for the CRP. [Full information](#) on all the consultations and comments received is online.

Insights emerging

On the smallholder focus

People in the face to face meetings strongly agreed with this. Smallholders “can be competitive” (Ethiopia), some “98% of the livestock producers are smallholders” (Tanzania) and “if capacitated can make an impact” (Tanzania). There were also qualifications and concerns: The CRP should not ONLY focus on smallholders but remember the other scales as well, including any pre-smallholder subsistence level; smallholders should not be seen as remaining ‘small’ or static, they should be helped to grow, transform or evolve, link to markets and the private sector and generally move into value addition activities (beyond keeping and producing). There was a concern on definitions, that a focus on ‘holdings’ would exclude pastoralists.

This smallholder focus attracted much attention on the online consultation. The conversation kicked off by saying that the smallholder focus “is not an option”, it is an imperative! Others elaborated on specific interventions for different production systems. As in the face to face discussions, caution was recommended not to see smallholders “as a homogeneous group” and not to miss the “influence large scale farmers/nucleus farmers have on the development of smallholders in their function as a possible growth catalyst.” Does the term ‘smallholders’ cover all categories of poor livestock-keepers? “What about the pastoralists who keep large herds ... There is need to define the smallholder, and whether it is in terms of livestock holdings alone or with reference to socio-economic status of the livestock-keepers and/or other sources of income besides livestock.” Further on this: “many livestock keepers do not have any land holdings and may have what seem to be fairly large livestock holdings but – especially in the drylands – many head of livestock per family member are needed for survival of the family.” As one contributor said: “the smallholder focus is very relevant, but should include a profound analysis of them.”

Further, it is “important that our research also includes the many other actors/stakeholders that contribute to the changes we anticipate to see for the smallholder farmer” and to “add the dimension of the future of farming as a business. That means not just productivity increase, but also

livelihoods and how to grow from smallholder to medium sized farms with a good future and increasing options for investment.”

One contributor argued that an “emphasis on pastoralists and medium-sized farmers will be more promising [than smallholders] in the long run, if we look at it from a demand perspective. Smallholders, by definition, engage in a variety of income-generating activities of which livestock is only one. Once they earn enough to send their children to school they usually stop keeping livestock. It’s of course great from the perspective of poverty alleviation, but not great from the perspective of sustainable livestock production. Encouraging pastoralists and paying them for environmental services in addition to creating opportunities for good income from their products will probably make more long-term sense.”

On livestock ‘goods’ and ‘bads’

The online platform asked whether livestock research prioritize livestock ‘goods’ (eg., livelihoods, manure, traction, nutrition) or livestock ‘bads’ (eg., emissions, obesity, public health, water use) and how the proposal could strike a correct balance.

Generally, contributors argued for ‘a balance’ but came down in favour of the ‘goods’. “A livestock research program should always bear in mind the reduction of the bads while implementing the goods”. One contributor argued to focus on ‘livestock goods’ first. “Once farming is profitable then the ‘bads’ should be addressed through creating awareness on mitigation measures since they are likely to incur costs.” A significant point made was for this livestock research for smallholders “should prioritise ‘goods’ as smallholders cannot be kept accountable for the ‘bads’... Smallholders must first of all aggregate capital before they can invest as individuals in reducing the ‘bads’. And mind you, per capita these ‘bads’ are significantly smaller as compared to large scale farming.”

On the trajectories of change

People seemed to grasp the differences and found the characterization between strong growth and fragile growth to be useful. They warned that the lines are blurred, that they should not be looked at independently nor framed as either/or, and that both ‘strong’ growth trajectories may start having externalities.

Some contributors to the online platform argued for caution (and also differentiated approaches). Arguing that “pastoral systems are often the most ecologically sound way of using dryland resources” it was suggested that “rather than trying to intensify pastoral systems and reduce their flexibility, ways need to be found to ensure that they can continue to operate – that key resources are not blocked off for other purposes, disrupting the wider mobile pastoral system of using dryland resources. Much more attention needs to be given to issues around resource-use rights and multiple use of resources by different producer groups that do not undermine each other. This calls for social and institutional types of research and innovation.”

In a similar vein: “Don’t take the basis of livelihood of women and their families away by focusing research on resource-intensive and often environmentally detrimental forms of processing and marketing to meet only the needs of high-income earners.” Instead, “continue to give attention ... to pro-poor systems of processing and marketing animal-source foods so that both poor producers and poor consumers can benefit in terms of both income and nutrition.”

On the research drivers

Research drivers identified in rapid inclusive growth systems included functioning of markets, productivity, environmental adaptation, biophysical intensification, growing demand, decreasing labour availability, infrastructure, land conflicts, and the interface between research on standards, regulations, markets, food safety, and production with research on issues like pollution, the

environment, culture, values, social structure. From the online platform, “a key element should be that the focus should not be put solely on the production side but on the whole value chain. Farmers can only benefit from a livestock program when they have access to markets to sell their outputs and/or processors.” And: a) Profitable and equitable integration of smallholders into milk, meat and by-products value chains. b) Production of safe and nutritious products. c) Opportunities for small holders to achieve a larger proportion of value-added in the above value chains. d) Reduction of environmental externalities and efficient use of wastes

Research drivers in fragile growth systems included climate change mitigation, emerging and re-emerging diseases, climatic shocks, insurance, property rights, adaptive capacities, risk, early warning systems, service delivery, commercially-viable resilience strategies, as well as unpredictability – biophysical and socio-economic. From the online platform: a) Enhancing livelihoods. b) Conserving natural resources/ecosystem services. c) Diversification of livelihoods, and:

- In drylands, systems are often quite resilient, based on a social systems as well as an economic and environmental limitations. mobility, stock exchanges, risk reduction, may arrangements are in place but very rarely supported by government, research organizations and development agencies. It seems to be very difficult to believe by high tech oriented people that soft innovations such as institutional development and socially based production systems are more important in many cases than technologies such as vaccination etc. Without the former, the latter will never reach its optimum. This means the land issue comes back, and also the need for jobs: though land productivity is huge in pastoral systems, labour productivity is not.
- Livestock systems that depend on seasonal movements are more and more in difficulties. Sahelian cattle searching for crop residues and pastures in valleys in more semi humid areas in coastal countries are less and less welcome. Traditional paths and pastures are taken under cultivation; more annual, perennial and lowlands crops are cultivated during the dry season and threatened by roaming and underfed cattle. Protected forests and even national game parks are turned into (illicit) cattle parks. Very few propositions on how to cope with the “problem” and how to turn it into opportunities have been formulated so far. Fodder cultivation, hay making, cultivated fields, enclosure with legume shrubs or *Jatropha*, Corridors are destroyed before their “participatory” marking has been completed. Policies are erratic, oscillating between wild repression (shooting at herds) and wild tolerance + bribes. Peaceful coexistence of former complementary natural resource users is seriously at risk.
- Look at systems rather than just livestock. Beyond livestock, to understand how the different farming system (and beyond that, innovation system) operate, and what change is needed.

On the integrated approach to deliver changes

Points arising included: Involving beneficiaries in designing and doing the research, keeping a focus on what’s needed not what donors want to pay for, critically assessing previous efforts, connecting well with extension and policy, differentiating approaches for different systems, e.g. transforming pastoralist systems through value system and participatory approaches, partnering with others, partnering with smallholder farmers, properly unpack notions around youth, and giving proper attention to participatory action research and learning on the ground. From the online platform, it was suggested that a smallholder focus should mean “research for them and with them”. From the online platform: “I would like to plead for a real participatory approach (Participatory Innovation Development or PTD), working together with all relevant stakeholders but taking care the voice and interest of the smallholder livestock keepers does not get lost.”

On capacity development, gender, and communications

Participants strongly argued for greater emphasis and support for capacity development, but that its effectiveness needs to be measured. From online: “It is important that capacity development is not seen as a one-off intervention but is multi-dimensional and multi actor process that goes well

beyond transfer of skills and knowledge at individual level (training). Critical institutional capacities required to deliver impact at scale would include facilitation for collaboration, navigating complexity, reflection and learning, and engaging in strategic and policy processes-by bringing in organisations with an intermediary role to help facilitate capacity building.”

On gender, capacity issues – to undertake gender research – were highlighted as well as needing to integrate it from the outset of planning. From online: To ensure gender equity, “take into consideration the different behavioral attributes of men and women in varying contexts. This may improve understanding of complexities in gender inequality-beyond just the needs, interests, power and resource distribution that commonly defines gender equity and equality interventions.” “The proposal’s focus on “‘strong growth’ through sustainable intensification of livestock-based systems” sends warning signs: there are some livestock activities that generally remain the purview of women and key sources of livelihoods and food security. Increased commercialization of these activities can lead, as we have learned from other designed shifts in value chains, to displacing women.”

Communications should be part of the theory of change and impact pathways, it should be multi-dimensional, community focused and employ diverse local information delivery systems, media, and ICTs. Connecting again extension was seen to be important as well as ‘mass campaigns’ and, in more targeted ways, influencing the right persons – government, policy makers, private sector, and other players.

On roles for the private and public sectors

A Tanzanian participant suggested that the “private sector should provide inputs and markets, while the public sector provides knowledge and information.” In the ILRI conversation, a similar distinction was drawn: For the private sector, partnership in research and downstream delivery and input service supply (particularly through the use of innovative technologies in fragile systems); for the public sector, regulation, market infrastructure. “The role of the private sector is to ensure there is a strong market, regulated by the public sector.”

It was also argued that these roles change in the different growth trajectories. In fragile growth systems, public sector takes on greater responsibilities. In more market-orientated systems, the role of the private sector grows. This is not to say that there is no place for the private sector in fragile systems or the public sector in strong growth scenarios. Further on this from the online platform: Public sector role is to “support and allow the development of technologies for small scale production (high potential areas) and flexible technologies for the drylands. The systems differ. That means also for public partners: land rights, job creation for those who cannot be sustained by the system. Private: producing and distributing tech that can be used in small scale systems, risk averse.” In terms of research collaboration with the private and public sectors, an online contributor said:

“The private sector has a role in both testing our research products and scaling. Inviting collaborations with the private sector is one way to engage. The public sector is also a key partner in cultivating sustainability of adopted technologies. Understanding of the research process by both private and public sectors is an incentive to their technology uptake.”

“Communication is of vital importance regarding collaboration between research and private companies. Private companies have to express their needs as well as their willingness to in some cases fund and more importantly implement developed technologies. Research has to bear in mind the practical adaption of their developments. To reduce any kind of transaction costs, research and private companies should stress an exchange as early as possible at the beginning of a new project/program.”

Notes from the face to face discussions

Importance of livestock

- Livestock is a strategic pathway for wealth creation (Uganda)
- There is an increasing demand of livestock and livestock product demand especially 'white meat' (Uganda)
- There are plenty of new technologies, innovations and information that enhance livestock development (Uganda)
- There is more and more involvement of women and youth in livestock (Uganda)
- Livestock has a huge potential for employment (Uganda)
- There is an emerging leather industry (hides and skins) (Uganda)

But:

- Limited market and marketing infrastructure (Uganda)
- Limitations of value addition in livestock products (Uganda)
- A lack of functional disease control strategies for disease mitigation (Uganda)
- High food quality and standards challenges (Uganda)
- High effects of HIV/AIDS on enhanced productivity (Uganda)

How could the assessment of livestock related opportunities to address development challenges be strengthened?

- Strengthening could be done through: Multi-stakeholder involvement and giving priority to action research (research should come from the beneficiaries, not donor driven agenda). (Tanzania)
- Deploy multi-stakeholder process effectively (Tanzania)
- Research has to be coupled with adoption studies (Tanzania)

Does the focus on smallholders make sense?

- Yes the focus on smallholder livestock makes sense (Uganda)
- Smallholders can still be competitive (Ethiopia)
- Focus on smallholder more likely to generate employment than focus on large holders (Ethiopia)
- They are the majority and if capacitated can make an impact (Tanzania)
- Yes if they get: Finance, education and ready market for their products. (Tanzania)
- Yes. About 98% of the livestock producers are smallholders. (Tanzania)

Commentary on smallholder focus

- But also focus on medium and large scale (Tanzania)
- But they should be facilitated/educated/sensitized to change into medium/large scale. (Tanzania)
- Medium and large scale commercial production (dairy ranches, cattle fattening, poultry etc.) should also be supported by creating favorable policy and business environment. (Tanzania)
- But: How does the smallholder farmer influence the research agenda and how best can the results from the research agenda trickle back to the smallholder farmer in the absence of strong 'farmer-research-extension linkage? (Tanzania)
- The crucial thing is how to organize them into collective action to access business development services (Tanzania)

- There is no clear strategy on how farmers will be helped to ensure the transition from subsistence to commercial farming. (Uganda)
- Value addition and processing of livestock products (Uganda)
- The lack of strategy for value addition amongst smallholder farmers should be explored (Uganda)
- Livestock as pathway for enhancing human nutrition is not well articulated (Uganda)
- A strategy for technology transfer to livestock value chain actors not clear? (Uganda)
- How to strengthen policy and regulatory issues (e.g. land, seed, commercial feeds policy) (Uganda)
- Gender issues are not coming out well right from the beginning (Uganda)
- Market did not come out clearly. What does the farmers do with the increased quantity of production? Are the markets big and responsive enough (Ethiopia)
- Include medium and large scale farmers especially for dairy? (Ethiopia)
- Fear that pastoralists could be excluded (Ethiopia)
- Look at smallholders from a consumer perspective (Ethiopia)
- Market aspect crucial (Ethiopia)
- Environmental issues with smallholders – preservation of products (Ethiopia)
- Definition of smallholders? Should consider many aspects, consider context - livelihoods (Ethiopia)
- The role of cooperatives and micro finance is crucial (Ethiopia)
- Link smallholders with private sector, large scale farmers? (Ethiopia)
- Smallholders versus large scale farmers eg, dairy processing needs to be considered (Ethiopia)
- Income generating activities for women (Ethiopia)
- Graduate smallholders to large scale system should be designed over the years (Ethiopia)
- How to make smallholder market oriented should be areas of research (Ethiopia)
- The case for smallholder is there (all the pieces are there) but the argumentation did not come out strongly. (KIT)
- The human population growth leading to decreasing farm size connection needs to be addressed because: Not all smallholding is desirable or economically or environmentally sustainable- and may lead to poverty traps. But also that smallholders will not disappear. Is it clear that we're not smallholder fundamentalists (ILRI)
- Smallholder farmers are producers but they are also consumers. (ILRI)
- For small scale holders- I have a feeling that many people are moving away from agriculture (livestock included) as farming is increasingly become non-rumenerative profession we are focusing only on the technology part and other elements are beyond our reach (ILRI online)
- Do we focus only on smallholders or are we open to medium scale or to where the risks are high? For example in Vietnam, the size of 30-100 pigs are more and more common. For profitable farming size is critical and probably we may have to include medium scale operations (ILRI online)

Commentary on the organization of research for development priorities around trajectories of change, especially what's missing

- Missing or weak: Property rights – especially land tenure for both strong growth and fragile growth trajectories (Uganda)
- Missing or weak: Early warning systems for coping with shocks (climatic and biotic) (Uganda)
- Missing or weak: ICT applications for technology delivery (Uganda)
- Missing or weak: Trans-boundary diseases (Uganda)
- Missing or weak: Traceability systems (Uganda)
- Strong growth trajectories may start having externalities (Ethiopia)
- Missing or weak: Urban poor (poor urban livestock systems) Ethiopia)
- Trajectories couldn't be looked out independently (Ethiopia)
- Fragile growth trajectory (for enhancing resilience) should also be considered for Uganda (besides the intensification – value chain). Justification is that pastoralism system in the cattle corridor is prominent too. (Uganda)
- All three trajectories are important - smallholders should not be looked at in isolation. The scenarios should not be framed as either/or as all are relevant. (KIT)
- The focus seems to be on markets more than livelihoods: producers for markets rather than for themselves. (KIT)
- In terms of future perspective, the fragile growth systems, given demand and ways of meeting it, could become high growth and high potential areas leading to new externalities. Needs to allow for this structural change. (ILRI)
- It is very clear that these transformations, from subsistence to market-orientated, from fragile to resilient, will affect young people, men and women, smallholders and larger-scale farmers very differently. We need to develop an overall institutional framework for sustainable intensification (integrated research and policy agenda), which takes into account the different growth scenarios (strong, high and fragile). And also ask the question how sustainable are intensifying systems? (ILRI)

What are the top issues driving research on sustainable intensification of livestock-based systems?

- Access to both input and output markets (Uganda)
- Proper functioning of the input and output marketing systems (Uganda)
- Overlap strong growth + fragile growth trajectories (ex. Pastoralist system) (Ethiopia)
- Role of livestock in x-systems? (Ethiopia)
- Productivity is key (Ethiopia)
- Adaptation environmental (Ethiopia)
- Markets (temporal fluctuations) (Ethiopia)
- Technologies (example Dairy) – Value chain development needs to have long term perspective (Ethiopia)
- Environmental resources (Ethiopia)
- Biophysical intensification (surface + underground) (Ethiopia)
- Growing demand (Tanzania)
- Decreasing labour force in agriculture and livestock systems in some ecological zones (Tanzania)
- Seasonality of feed resources (Tanzania)
- Infrastructure for products collection, processing and trading (Tanzania)
- Animal health management and disease control (Tanzania)
- Inputs and services provision. (Tanzania)

- Issues come from the stakeholders that affect the majority such as climate issues, feed, land conflict between livestock keepers and farmers (Tanzania)
- Thinking of intensification takes research into areas of standards, regulations, markets, food safety, production, etc., while sustainability looks at research areas related to issues like pollution, the environment, culture, values, social structure etc. (ILRI)
- There is an assumption that intensification is going to happen, we have to look at the linkages. But what exactly are we talking about when we refer to intensification, is it market-orientation? Will there be intensification in fragile systems? (ILRI)

What are the top issues driving research on enhanced resilience for livestock-based livelihoods?

- Building capacity of smallholder farmers/strengthen towards mitigation of climate change (Tanzania)
- Emerging and re-emerging diseases, including zoonoses (Uganda)
- Environmental concerns – especially climatic shocks (Uganda)
- Policies around financing and insurance systems, property rights (Uganda)
- Improve adaptive capacity? (Ethiopia)
- Need institutional arrangement (Ethiopia)
- Improve proactive risk models and early warning systems (Ethiopia)
- Markets, increase off – take (Ethiopia)
- Linking different production systems (Ethiopia)
- Animal health service delivery (Ethiopia)
- Markets (temporal fluctuations) (Ethiopia)
- Market problems (Camels + small ruminants) (Ethiopia)
- Commercially viable resilience strategies (Ethiopia)
- Unpredictability , bio –physical , socio-economic (Ethiopia)

Comments on the portfolio of integrative research – what the Program proposes

- More focus: social economics of the interventions (cost- benefit) (Uganda)
- More focus: building in research on the impact of human health and nutrition (Uganda)
- More focus: Market information/intelligence (Uganda)
- More focus: How the whole effort is linked to market (Ethiopia)
- More focus: Animal welfare and drudgery technologies that are low cost and cost efficient (Uganda)
- More focus: Forage breeding and promotion local forage species (Uganda)
- More focus: Feed safety issues (Uganda)
- More focus: Feeds research on emerging feeds e.g. vermiculture - insects (as alternative sources of protein) (Uganda)
- More focus on Management - both husbandry management and enterprise management (Uganda)
- More focus: Market access and value addition (Uganda)
- More focus: research on environmental degradation and impact shown to the beneficiaries (Tanzania)
- More focus: Public health and food and feed safety (safe livestock products) (Uganda)
- Gender is not coming out well right on higher issues (Uganda)

- Issues of animal welfare and management (housing, transportation) are not addressed anywhere in the proposal. (Uganda)
- Small scale mechanization (such as low cost mechanization equipment for chopping feeds) is missing especially in the cattle value chains. Farmers are exposed to risks and drudgery in the livestock value chain. (Uganda)
- Forage breeding of existing varieties (conservation aspects) should also be a focus rather than introducing new varieties (Uganda)
- Having a specific environment flagship is an excellent addition to the portfolio. That said, the issue of the environmental impact and risks related to livestock production - for example, climate change contributions, ecological footprints etc. - are not brought out well. Much more weight needs to be given to the environmental impact and what the CRP will do to explore, analyze and address this. It is a growing concern internationally and response to that discourse comes out too late in the story (presentation narrative). (KIT)
- How can the CRP link to other forms of social protection? Especially in the Livelihoods and Environment flagships, this may be relevant. (KIT)

Commentary on the approach to deliver stepwise, transformative changes leading to sustainable, resilient livestock systems – mainly on what’s missing or needs more attention

- Use large commercial farms pastoralists and agro-pastoralists with large herds to produce cross breeds on contract basis e.g. using sexed semen. (Tanzania)
- Involve smallholders/beneficiaries in the development of the research agenda as well as during the research (Tanzania)
- Researchers in Tanzania are doing donor driven research for funds not to meet demand from the local livestock sector. (Tanzania)
- Need more Critical analysis of previous efforts and strategies or inclusiveness of previous and targeted interventions and ignoring local/indigenous knowledge and experiences (Tanzania)
- The link between research and extension portfolio was not very well articulated in the proposal (Uganda)
- More focus: Policy, legal and regulatory issues (Uganda)
- More focus: Capacity on finances infrastructure , human and ICT (Uganda)
- More focus: Research that guide policy (Uganda)
- Transformation is beyond incremental changes (Ethiopia)
- Address the issues for smallholders farmers holistically (Ethiopia).
- More focus: Indigenous technology knowledge generation and use (Uganda)
- Political vs research agenda: does the political will drive on research guided by professional synthesis or research priorities based on data? How do the two merge and harmonize based on evidence-based policy analysis? (Tanzania)
- Consider R4D on livestock-crop integration both as enterprises and delivery of integrated extension service provision. (Tanzania)
- Need to modernize/transform pastoralist’s production system through value system and participatory approach, business development that suits the pastoral production system. (Tanzania)
- Weakness in research delivery is that we stress on research/extension linkage and less on research/production linkage. (Tanzania)
- The fragile growth (resilience) focus is convincing, however it is messy and hard to measure. It is important to collaborate with other organizations working on this and link to these other programs. (KIT)

- Smallholders are an important focus, but there is a need to move beyond rhetoric, to the nature of partnerships with smallholder farmers and creating meaningful partnerships. (KIT)
- The partners mentioned in the presentation are primarily the 'usual suspects'. For new thinking, more social science and local partners would be beneficial. (KIT)
- The category of 'youth' needs to be broken down to expose its heterogeneity – which youth? We need to move away from assumptions and perhaps use a 'life cycle approach' and intersectionality, which would support the CRP in 'unpacking' the youth category. Link the rationale of outreach to youth to the rural-urban shift. (KIT)
- There is little or no mention of participatory action research (PAR). Instead the learning approach focusses on a higher level, CGIAR-wide learning rather than on-the-ground, local learning and how the CRP will engage with that. For example, when aiming for gender transformative change, PAR helps to take that kind of change forward and this is missed in the presentation. More on methodologies and how they are used locally and in communities would be welcome.
- Most of the integrative research appears to be in the LLAFS flagship, but this perspective is needed across the whole CRP e.g. systems research. Leaving it all to one flagship is likely insufficient. (KIT)
- The CRP Livestock is covering a lot of ground, particularly the social science side. Choices should be made to narrow the focus down and strongly argue for comparative advantage. Go for depth rather than breadth. (KIT)
- There could be differential understanding and perceptions about transformative changes, we need to have this grounded in what it looks like in real life context, before we can go say that we know how to deliver transformative changes. (ILRI online)
- Ingredients for transformative change: technology, access/means to technology, policy support, enabling systems and institutions (ILRI online)

How best can we integrate capacity development, gender, and communications?

- Capacity
 - This area needs supported, well trained and equipped extension staff, which is the role of government through local government authorities which unfortunately have not showed interest to develop or support. (Tanzania)
 - Human + material – the emphasis is vital (research facilities) (Ethiopia)
 - The emphasis needs to be increased (Ethiopia)
 - Need to measure the effectiveness of capacity development efforts (Ethiopia)
 - Need for community controlled processes linking capacity development and communication agenda (Ethiopia)
- Gender
 - Clarity of the gender component (Ethiopia)
 - Integrating the gender component at the outset of planning Capacity to undertake gender research (Ethiopia)
 - Involve women in all activities along the value chain (Tanzania)
 - Capacity - human + material (Ethiopia)
- Communications
 - Needs to be part and parcel of the TOC/IP (Ethiopia)
 - Using the information generated (Ethiopia)
 - Communication shall be multi-dimensional (Ethiopia)
 - Need for community controlled processes linking capacity development and communication agenda (Ethiopia)

- Include use of local information delivery systems e.g. role plays (skits), the local media (newspapers, local television shows, and radio programs) and use of ICT technology (Uganda).
- This can be done by use of groups, focus groups and radio programs (Tanzania)
- Use of extension so that the finding can reach out to large numbers of stakeholders. (Tanzania)
- Mass campaigns to communicate and change mindsets/perceptions. (Tanzania)
- Research for development on ICT platform to strengthen information sharing (Tanzania)
- To achieve impact you need to influence the right persons – government, policy makers, private sector, and other players (ILRI)

What are key roles for private sector and public sector?

The role of the private sector should be to provide inputs and markets, while the public sector provides knowledge and information. (Tanzania)

Need to make a clear distinction between the different growth scenarios, for instance, in fragile scenarios, there will tend to be a greater burden placed on the shoulders of the public sector. Depending on the production system, as one moves into a more market-orientated systems, the role of private sector grows. But can private sector play a role in replacing the services provided by the public sector? Do they provide more efficient / better services? This is not to say that there is no place for the private sector in fragile systems or the public sector in strong growth scenarios. The role of the private sector is to ensure there is a strong market, regulated by the public sector. Moreover, this approach seems to assume there are no connections between strong and fragile growth scenarios, in fact there are increasing connections, and these interconnections need to be reflected in our research and policy development. (ILRI)

Concrete roles for the private and public sectors: Private sector: partnership in research and downstream delivery and input service supply (particularly through the use of innovative technologies in fragile systems). Public sector: regulation, market infrastructure. (ILRI)

For private sector:

- Deliver improved genetics to farmers e.g. semen, technologies services (ILRI)
- Test and feedback, recommend to farmers (ILRI)
- Invest in research and technology (chicken example) (ILRI)
- Capacity building for adoption of technology; encourage/engage youth (ILRI)
- Gene discovery traits interesting to them (heat tolerance) (ILRI)
- Lead livestock development drivers (Tanzania)
- Policy and legal framework implementation (Tanzania)
- Shared settling and implement livestock development agenda (Tanzania)
- Formal land and development (Tanzania)
- Invest (Tanzania)
- Change to commercial from traditional (Tanzania)
- Enquire/demand research findings (Tanzania)
- Provide quality products (Tanzania)
- Production, processing, transportation etc. (Tanzania)
- Under guidance from the public sector, they may assist in extension (Tanzania)

But challenges include:

- Not stable partnership (ILRI)
- Definition of private sector, farmers also private sector (ILRI)
- Engage private sector in a fair way, not creating competition (ILRI)

Public sector

- Enabling environment: policy (ILRI)
- Engage policies at regional level (ILRI)
- Facilitate, create rewarding environment (ILRI)
- Food safety, health, environmental issues. (ILRI)
- Conducive policy (Tanzania)
- Regulatory role (Tanzania)
- Set the development agenda (Tanzania)
- Land and land resources ownership (Tanzania)
- Facilitate with information and technology use (Tanzania)
- Provide extension services (Tanzania)
- Facilitate research for development (Tanzania)
- Demonstrate and invest other livestock sub sectors like beef (Tanzania)
- Provide animal health and veterinary services (Tanzania)
- Leverage importance of livestock campaigns on changing and adopting technologies and habits in consuming milk products (Tanzania)
- Fund research which will solve problems in their enterprises (Tanzania)

Contributions to the online platform

The focus of the proposed program

1. Does the focus of the program on smallholders make sense? Will we miss anything crucial in this focus?

1.1 The program is well focused and makes sense and will not miss out anything crucial. The balance can be struck by looking at ways to ameliorate enteric methane emission from animals in order to improve their productivity thereby enhancing livelihood of the people especially in rural areas.

1.2 The focus on smallholders in livestock related programs is not an option. It is rather a priority because livestock activities are majorly practiced by this target group in almost all developing economies. The focus on smallholder communities is even most relevant when we consider the sub-Saharan Africa. Research on livestock agri-food system is unthinkable without a focus on smallholder farmers. They are part of the system where the impact of the scientific research finally reveals itself in the form of increased household income, improved nutrition and health conditions. The issue is then to identify and decide on the cutting-edge research themes that should be undertaken with an immediate socioeconomic impacts on that target group, preferably, and leading to long-term, sustained and increased outreach to millions of smallholder families along the trajectory of growth.

1.3 Yes the focus on smallholder matters. But it's not well articulated in the statement. Apart from mentioning that SHFs are important. I think there is need to put a more grounded basis for mainstreaming SHFs in the agri-food system.

1.4 I think the smallholder focus does make sense. We have evidence of uptake of piecemeal innovations (grazing, water, vaccination of chicken and smallstock, the usual suspects as far as smallholders are concerned). we also have evidence for quite considerable improvement in productivity, of between 50-100% depending on type of livestock and management. what is needed

is the appropriate technologies, and surprisingly that has not been coming forth very much. there is still huge potential in many areas. this includes providing quality inputs and providing a reliable and decentralised milk collection sector. all this is in the higher potential areas. integrated farming (crop-livestock) is a serious option there. for oxen, the same applies and zero grazing is an option but often when the farms get smaller, zero grazing even is impossible. the farms are too dense to have enough grazing left. creating jobs for farmers and their families to earn enough to invest is necessary: they might be able to afford mechanised forms of tillage (but will lack the fertility-function of livestock). i think you should make clear what type of livestock production you are talking about: this is all relevant for high potential areas. what about drylands? usually for meat production? same applies in a sense: there is lots of potential to improve gradually and without risk the herd productivity. but drought risk is a concern. also, the land issue is important there in a different way as in the wet areas: land is being taken by various uses (urban, tourism, ranches, wheat etc). and the market is not always close: how to process meat for the urban market?

1.5 I think you should distinguish between high potential areas and drylands. in the first there is ample perspective on improved productivity for small holders. incremental change will gradually increase that by 50-100 % as we have evidence of this. risk reduction, small changes to test technologies, for chicken and small stock mostly i think as this is smallholder farming. fertility in integrated systems will allow reduced input levels of fertiliser, spending should be on animals health, vaccination, feeds. for larger animals: usually milk and oxen. the latter may be reduced due to smaller and smaller lands. mechanisation of a sort is needed then: less manure and jobs are needed to earn the money . and business cases for renting out tractors (2wheel), but only after the low hanging fruit of smaller tech is done. the milk: great potential yet. very little is done to promote SS milk production; good inputs and a reliable market will allow huge gains in think. this has only started even in kenya. the drylands are different but the same: meat usually, and small change is preferred: water, feeds, but mostly better crossbreeds (never the high productivity stuff) and animals health are crucial. when the market is allowed its way, this will develop too. the thing is: land is being taken away: urban. tourism, ranches, agriculture such as wheat.

1.6 The focus of this program makes sense; given the majority of farmers in developing countries are smallholders. One issue that is often not considered is that smallholders are seen as a homogeneous group though they are quite heterogeneous regarding their specific situation (differences in countries, regions, the institutional framework, production systems ...). However, the often crucial influence large scale farmers/nucleus farmers have on the development of smallholders in their function as a possible growth catalyst should be considered too.

1.7 The focus on smallholders make sense considering that in our region, most of livestock farming is practiced under smallholder production system which contributes significantly in national GDPs.

1.8 The focus on smallholder sounds right. The smallholder farmer is however at the far end of the research and development continuum. It is therefore important that our research also includes the many other actors/stakeholders that contribute to the changes we anticipate to see for the smallholder farmer. This is especially in understanding how these actors advance the use of our research.

1.9 The smallholder livestock make a sense but it will depend on type of animals, potentiality of each region. The good way is to analyse country concern by country and promote the kind of each area depending on his potentiality.

1.10 The smallholders focus makes a lot of sense for reasons already indicated. However it would be advisable to add the dimension of the future of farming as a business. That means not just

productivity increase, but also livelihoods and how to grow from smallholder to medium sized farms with a good future and increasing options for investment.

1.11 The idea of increasing in-country production to satisfy consumer needs makes sense, but not so sure about the focus on smallholders. Emphasis on pastoralists and medium-sized farmers will be more promising in the long run, if we look at it from a demand perspective. Smallholders, by definition, engage in a variety of income-generating activities of which livestock is only one. Once they earn enough to send their children to school they usually stop keeping livestock. Its of course great from the perspective of poverty alleviation, but not great from the perspective of sustainable livestock production. Encouraging pastoralists and paying them for environmental services in addition to creating opportunities for good income from their products will probably make more long-term sense.

1.12 Small Holders are traditional practices and they are the basic from where we all started, The growth of livestock was as a result of the reserved breeds developed from small holders. It is not a waste of time to think back and look on what worked, What can we do, And how to scale up the productions of small holder and make their livelihood better. Sure this group needs encouragement and should not be abandoned. The small holder should be give the newly research high breed, and be supported with funding to increase their capacity and output.

1.13 The smallholder focus is very relevant, but should mean “research for them and with them”. Knowing the barriers for adoption of research technologies by smallholder is key if one wants to make impact. Country policies, strategies, priorities in agriculture should be analyzed and well known in order to guide country choice. How and when can a research program have made impact? easier with development programs, but hard in research program....there is need to establish a M&E tool to capture this....

1.14 The smallholder focus is very relevant, but should include a profound analysis of them. Smallholders are too divers to be put into one category that can be served by ILRI research. This has been the pitfall of many good intentions. Yes, smallholders have in common that they raise limited numbers of livestock, but there are more dominant production factors that differentiate them, making it impossible to refer to them as a uniform production unit. Though we know the problem, most evidence of this has been provided by anthropological research and only limited research into this phenomenon has been done by livestock-related sciences. See also our (KIT) working paper ‘Enhancing rural labour productivity: how to reach the rural poor’. In this paper we summarize the results of a systematic review of literature on evidence of impact of agricultural research on the rural poor. Key conclusion is: the very poor depend on wage labour for income, and for food security on marginal crop- and livestock production. Conventional agricultural research do not serve the interests of the latter. A pro-poor agenda would consider the nutritional return to labour, not raising farm productivity through intensification. So: unpacking the smallholder concept is of ultimate importance if we want to make any impact in the future.

1.15 Regarding the focus on “smallholders”, it depends how you define them. Many livestock keepers do not have any land holdings and may have what seem to be fairly large livestock holdings but – especially in the drylands – many head of livestock per family member are needed for survival of the family. Pastoral systems are often the most ecologically sound way of using dryland resources. Rather than trying to intensify pastoral systems and reduce their flexibility, ways need to be found to ensuring that they can continue to operate – that key resources are not blocked off for other purposes, disrupting the wider mobile pastoral system of using dryland resources. Much more attention needs to be given to issues around resource-use rights and multiple use of resources by

different producer groups that do not undermine each other. This calls for social and institutional types of research and innovation.

1.16 Another area in which ILRI has been giving attention in the past and needs to continue to give attention is that of pro-poor systems of processing and marketing animal-source foods so that both poor producers and poor consumers can benefit in terms of both income and nutrition. In the informal markets for animal-source foods, women play a key role, and this role needs to be strengthened or at least maintained. Don't take the basis of livelihood of women and their families away by focusing research on resource-intensive and often environmentally detrimental forms of processing and marketing to meet only the needs of high-income earners. I agree that your third scenario offers the greatest potential for a research program to improve the quality of low-income diets, reduce import costs, reduce poverty and make more efficient use of natural resources.

1.17 Do smallholders cover all categories of poor livestock-keepers? What about the pastoralists who keep large herds but are disenfranchised and need attention. Therefore there is need to define the smallholder, and whether it is in terms of livestock holdings alone or with reference to socio-economic status of the livestock-keepers and/or other sources of income besides livestock.

1.18 Yes. With the continuous subdivision of land to smaller and smaller units thus creating a myriad of small scale farmers it makes sense to focus on such farmers. Encourage and promote farming as a business. Subsistence farming will not yield the desired results.

1.19 Does the focus of the program on smallholders make sense? Will we miss anything crucial in this focus? The focus on small holders makes perfect sense. However, as you state, it is likely that investments in larger-scale feed lots will occur in parallel. The competitiveness of these small holder systems vis a vis the feed lot approach will need to be assured.

2. In developing countries, should livestock research prioritize livestock 'goods' (eg., livelihoods, manure, traction, nutrition) or livestock 'bads' (eg., emissions, obesity, public health, water use)? How do we strike a correct balance?

2.1 Livestock research in developing countries should keep the balance between understanding both the 'goods' and 'bads' of the sector and should lead to the reduction of the 'bad' effects of the sector by bring in innovation so that the environment and human health are not compromised. Research on the 'good' things should focus on improving livestock production systems and productivity to keep the production-consumption function in balance, with the likely expectation that both the human population and the demand for livestock source foods increase. The research on the 'bads' could help inform consumers on the appropriate use of animal source foods without jeopardizing human health and the use of technologies to reduce the negative impacts. For the developing countries it is unlikely that the use of livestock for food and non-food purposes would be ignored for years to come.

2.2 I think the goods still outweigh the bads, but development of those goods with an eye on the bads, would be good. eg better feeds improves animals growth and quality but can reduce methane production as well. different types of animals do that too. kangaroo, i'm not kidding, has almost no methane production. but serious: this can be managed at the same time.

2.3 A research prioritization is neither so easily achievable nor is it desirable from a sustainable development point of view. A livestock research program should always bear in mind the reduction of the "bads" while implementing the "goods".

2.4 The smallholder livestock production has many constraints: poor livestock breeds, poor animal feeds, pests and diseases, small land holdings, poor infrastructure etc. Research should therefore focus on both “goods” and “bads” to ensure maximum productivity of the sector while also taking into consideration on public health and environmental aspects.

2.5 The bad or good issues of research prioritize on livestock are important to prevent any unbalanced question. A good research must prevent and avoid the trade-off.

2.6 Would be wise to look both at goods and bads. You always have to work with increasing benefits (goods) and reducing costs (bads). Including environmental costs etc.

2.7 I am of the opinion that livestock research should prioritise ‘goods’ as smallholders cannot be kept accountable for the ‘bads’. The latter can be addressed through payment for community and nature conservation services. Smallholders must first of all aggregate capital before they can invest as individuals in reducing the ‘bads’. And mind you, per capita these ‘bads’ are significantly smaller as compared to large scale farming.

2.8 Both the “goods” and “bads” of livestock production should be addressed with the goal of increasing the former and decreasing the latter in each production unit.

2.9 what is the goal of the program? to alleviate smallholders out of poverty by increasing productivity and incomes by moving towards more industrial systems, and therefore ‘bads’ or is it to make smallholder production systems more viable and sustainable? we need research that will take cognizance of the variability and ways to manage it in a realistic manner.

2.10 My view is that you focus on ‘livestock goods’ first. Once farming is profitable then the ‘bads’ should be addressed through creating awareness on mitigation measures since they are likely to incur costs.

2.11 This CRP needs to look at both. The livestock goods should be a major focus of the Livestock CRP; in conjunction with other AFS CRPs where it makes sense (e.g., dual purpose maize). However, for livestock bads, there should be significant involvement of/collaboration with CCAFS (emissions), A4NH (obesity and public health) and WLE on water use/quality. Of course, other selected international organizations and ARIs should also be involved.

3. What are the top issues that should drive research on the sustainable intensification of livestock-based systems?

3.1 The top issues that should drive research on the sustainable intensification of livestock base system are: increasing demand for livestock products and the production response.

3.2 Next to the introduction of new technologies and good agricultural practices, a key element should be that the focus should not be put solely on the production side but on the whole value chain. Farmers can only benefit from a livestock program when they have access to markets to sell their outputs and/or processors. Supply should reach the demand. This is one necessary condition to improve the nutritional situation of a society and to improve the situation of farmers.

3.3 a) Profitable and equitable integration of smallholders into milk, meat and by-products value chains. b) Production of safe and nutritious products. c) Opportunities for small holders to achieve a larger proportion of value-added in the above value chains. d) Reduction of environmental externalities and efficient use of wastes

4. What are the top issues that should drive research on enhanced resilience for livestock-based livelihoods?

4.1 The top issues that should drive research on enhanced resilience for livestock base livelihood are the role of human agencies.

4.2 in drylands, systems are often quite resilient, based on a social systems as well as an economic and environmental limitations. mobility, stock exchanges, risk reduction, may arrangements are in place but very rarely supported by government, research orgs and development agencies. it seems to be very difficult to believe by high tech oriented people that soft innovations such as institutional development and socially based production systems are more important in many cases than technologies such as vaccination etc. Without the former, the latter will never reach its optimum. This means the land issue comes back, and also the need for jobs: though land productivity is huge in pastoral systems, labour prod is not, and population growth will hardly ever be contained within those systems: there WILL be an outflow. my studies in Kajoado kenya show that there is a max to the number of PASTORAL people in many districts, related to the land and growth curves of livestock and people. A longer term study will reveal the long term maxima of the system: that should be guiding in selecting the technologies.

4.3 Diversification should be considered as a measure to reduce risk. In addition, a focus should be put on the development of micro-insurance schemes.

4.4 Livestock systems that depend on seasonal move are more and more in difficulties. Sahelian cattle searching for crop residues and pastures in valleys in more semi humid areas in coastal countries are less and less welcome. Even “domestic” herdkkeepers encounter a lot of difficulties and troubles. Traditional paths and pastures are taken under cultivation; more annual, perennial and lowlands crops are cultivated during the dry season and threatened by roaming and underfed cattle. Protected forests and even national game parks are turned into (illicit) cattle parks. Very few propositions on how to cope with the “problem” and how to turn it into opportunities have been formulated so far. Fodder cultivation, hay making, cultivated fields enclosure with legume shrubs or *Jatropha*, Corridors are destroyed before their “participatory” marking has been completed. Policies are erratic, oscillating between wild repression (shooting at herds) and wild tolerance + briberies. Peaceful coexistence of former complementary natural resource users is seriously at risk.

4.5 Anne Floquet’s comments in fact point out to the importance of looking at “systems” rather than just livestock. Beyond livestock, to understand how the different farming system (and beyond that, innovation system) operate, and what change is needed. I am happy to see the attention to institutional change – change in policies, in the way people (livestock keepers, farmers) are organized, in the way organizations collaborate (or not). What is key is that this attention to institutional change be translated in enough capacity within the CRP to deal with these issues.

4.6 a) Enhancing livelihoods. b) Conserving natural resources/ecosystem services. c) Diversification of livelihoods.

5. What are the most promising gains that we can expect for smallholders from animal health research discovery and delivery? How do we best achieve these?

5.1 Smallholders expect to limit the rates of animal mortality. For example the vaccine against Swine african fever should promote a good productivity of the pork. Vaccine of tick-borne diseases can also enhance the productivity of the ruminants.

6. What are the most promising gains that we can expect for smallholders from animal genetics research discovery and delivery? How do we best achieve these?

6.1 Breeding animals for higher productivity that are adapted to local conditions (both feed lot and extensive production). How do we best achieve these?

6.2 The promised gains are the animal weight improved and reduce rearing time. The macrosatellite methods can help to go quickly.

6.3 Improved productivity through better genetics and management practices makes sense so long as: (i) the improved breed sustains productivity under the ambient disease burden and climatic condition, (ii) the cost of improved breed and management practice is offset in a sustainable way by increased profit, (iii) Points (i) and (ii) are proven in situ before encouraging small holder farmers in the target location to change current practice.

7. What are the most promising gains that we can expect for smallholders from animal feed and forages research discovery and delivery? How do we best achieve these?

7. 1 Greater investment in dual or multi-purpose crops. How do we best achieve these? Closer collaboration with AFS CRPs (e.g., MAIZE).

7.2 Animal should eat a sufficient and qualitative food to be able to exteriorize his genetic potential. The development of mechanization of agriculture can also help animal feed supply (crop residues, industry residues). Chemical analysis of feed available will help to improve the feed quality.

8. What are the most promising livestock research solutions or interventions we need to discover – or deliver – to meet the world's environmental challenges? How do we achieve these?

8.1 Ensure that the Livestock CRP adopts a systems approach to research and development.

8.2 In developing country agriculture and livestock are the most causes of environment destruction. The best way is to intensify the livestock and crop systems and reduce as possible the traditional systems, to reduce the number of illiterates for a good dissemination or have a good collaboration with the government for policy management.

9. What are the most promising livestock research solutions or interventions we need to discover – or deliver – to provide more and better animal-source foods to the world's poor? How do we achieve these?

9.1 Ensuring that appropriate innovations are accessible to smallholder livestock producers and adopted by them.

9.2 Reduce the rates of animal mortality, prevent epidemics, mainly the emergent diseases. Disseminate the good breeds and ensure a dissemination of improved systems with the smallholder farmers.

Delivering the program's research and development

It is a good document. I would like to plead for a real participatory approach (Participatory Innovation Development or PTD), working together with all relevant stakeholders but taking care the voice and interest of the smallholder livestock keepers does not get lost.

There will be promising entry points for action in each Flagship, but they will all be context-specific. And should be treated as such. That means that a lot of the questions raised now under the Flagship on livestock livelihoods and agri-food systems could serve as entry point for better understanding the system, and the diversity and complexity around it. Research to better understanding the farming systems, livelihoods, value-chain, policy implications have clear implications to all other Flagships. In other words: breeding will benefit from better understanding of the characteristics wanted and needed on certain animals, by certain farmers and markets; the trade-offs around livestock/agriculture/nature conservation; etc.

All Flagships should learn from feedback from different stakeholders working with the CRP, which is only mentioned in the Livelihoods and systems flagship. It is not clear how the different Flagships will function – how they will link to each other, feed into each other and learn. (Maybe it is just not written in this simplified version...!)

10. What are key roles for the private sector in livestock research and development? And the public sector?

10.1 Public sector: support and allow the development of technologies for small scale production (high potential areas) and flexible technologies for the drylands. The systems differ: I see not recognition of this in the text yet really. That means also for public partners: land rights, job creation for those who cannot be sustained by the system. Private: producing and distributing tech that can be used in small scale systems, risk averse.

10.2 In most cases the private sector plays an important role especially regarding the implementation of new technologies. Apart from the fact, that farmers are also part of the private sector, the private sector are the companies that sell the produced commodities. Thus, a close collaboration/coordination is needed so that the farmers produce what the private sector needs.

10.3 The private sector has a role in both testing our research products and scaling. Inviting collaborations with the private sector is one way to engage. The public sector is also a key partner in cultivating sustainability of adopted technologies. Understanding of the research process by both private and public sectors is an incentive to their technology uptake.

10.4 They are important to promote the intensification of crop-livestock systems and maintain a good market. The good policies in the country should help.

10.5 The private sector can boost also the intensification system and are also able to promote high technologies that smallholders can benefit.

11. How does research best engage with private companies in livestock technology discovery and delivery – what works and what does not?

11.1 Communication is of vital importance regarding collaboration between research and private companies. Private companies have to express their needs as well as their willingness to in some cases fund and more importantly implement developed technologies. Research has to bear in mind the practical adaption of their developments. To reduce any kind of transaction costs, research and private companies should stress an exchange as early as possible at the beginning of a new project/program.

12. What critical institutional capacities are necessary for livestock research to deliver impact at scale in developing countries – how can they best be developed

12.1 For livestock research to deliver impact at scale, there is need to first understand who are our target audiences, what conditions are needed to successfully engage them and the role they play in

advancing our research outputs. This information will contribute to developing institutional capacities needed.

12.2 Improving the use of research by livestock sector actors could be catalyzed by listing the actors, mapping their roles and establishing an engagement strategy.

12.3 The trilogy of research-dissemination and training is very useful. It is important to test how they are working to develop a good institutional capacity.

12.4 It is important that capacity development is not seen as a one-off intervention but is multi-dimensional and multi actor process that goes well beyond transfer of skills and knowledge at individual level (training). Critical institutional capacities required to deliver impact at scale would include facilitation for collaboration, navigating complexity, reflection and learning, and engaging in strategic and policy processes-by bringing in organisations with an intermediary role to help facilitate capacity building.

12.5 In my experience, at institutional level, senior management must have complete buy-in. Participants from capacity building exercises say that once they get back to the institution they cannot implement anything because the “bosses” are not interested in new ideas. I agree with the comments above that capacity development goes across the spectrum to all actors. Capacity development is also an ongoing process, not a one-off exercise.

13. Which ways to deliver capacities to livestock sector actors are most likely to produce results, in terms of improved use of research results?

13.1 To improve the use of the research results, it is necessary to involve all key persons involved in livestock sector. Schools primary, secondary and universities, associations, public sector, religions, private sector etc should be involved.

14. How do we best ensure that gender and equity issues are addressed and acted upon in livestock research for development?

14.1 To ensure gender equity I suggest: That we look at gender in a behavioral perspective; taking into consideration the different behavioral attributes of men and women in varying contexts. This may improve understanding of complexities in gender inequality-beyond just the needs, interests, power and resource distribution that commonly defines gender equity and equality interventions.

14.2 Some livestock are already managed by youth and women. It is important to promote that kind of livestock. There is many definitions of gender in the developing countries. The best ways should be to consider all family involve in the activities. In Africa, each gender play a specific role. The important thing is to minimize the exclusion in the society.

14.3 It's good to hear that “gender analysis is being embedded throughout the program at multiple levels”. My concern is that once gender analysis is embedded, research priority setting, dissemination and scaling would be already well on their way and difficult to amend given the analysis. For now, the proposal puts forward some clear propositions that beg for a clear gendered interpretation (which can quite easily be done by drawing on existing literature from over 45 years of women/gender related agriculture research): a sort of ex ante gender analysis if you will. For instance, the focus on smallholders is welcome but needs unpacking (as others have observed), not only for the diversity of realities this term conveys but also for interrogation into this “black box”. The concepts of small holder and households are related but often elided and used as a unit of analysis. Gender analysis requires us to understand the social relations of gender, particularly the gender relations of production, within the small holder household (to intra household relations) and

externally with social and economic worlds. So when we talk about focus on small holders involved with livestock, who are they? How are they socially positioned relative to other members within the household and the community? How is this profile changing given “feminization of agriculture”, gendered demographic trends (eg urbanization) and climate change (to name just three inter-related trends).

Additionally, while the questions for gender integrated research are welcome, they actually should be addressed as part of the proposal’s design. For example, the proposal’s focus on “‘strong growth’ through sustainable intensification of livestock-based systems” sends warning signs: there are some livestock activities that generally remain the purview of women and key sources of livelihoods and food security. Increased commercialization of these activities can lead, as we have learned from other designed shifts in value chains, to displacing women (so while the proposed question “How (would?) technological and institutional solutions impact on gender relations” is a welcome one, I wonder to what extent this has already been explored for the directions included in the proposal). Similarly, the research question of “How gender (in-)equality affects the technological and institutional solutions that are designed, delivered and studied” is an important one if this is about how assumptions in AR4D about social relations of gender (and farmers’ “knowledges” more generally) shape research priorities and design. In KIT’s work with [CRP MAIZE](#), for example, we found how different ways of thinking about knowledge and knowing impact different ways AR4D integrates gender concerns.

Concerning the strategic research questions, the first is valid (although somewhat broad and redundant if not a little confusing) whereas I was unclear what the actual questions are for the remaining two. Nonetheless, these highlighted issues are fundamental to the gender-integrated research agenda so the question for me is not so much about prioritizing between these two areas, but how to use findings from the strategic research to inform gender-integrated research. For example, dominant gender norms both influence research design as well as their update (it’s unclear which social/institutional contexts the question refers to and whose norms. Small holders?

Researchers and research organizations? I agree with Adeline and suggest both). So to understand how gender inequality affects technological and institutional solutions, one has to understand the role of social institutions and how they (re)produce gender norms and are also influenced by them. I was unfamiliar with some of the gender conceptualizations. What is the distinction between gender relations and dynamics? (they are similar concepts I think). What is the thinking behind asking about how gender equality affects technological and institutional solutions? (is this a case of looking for positive deviance?) What are women pro-active interventions? My assumption is that all gender-related initiatives are, by definition, needing to be pro-active.

15. How should we prioritize between gender-integrated and gender-strategic work?

15.1 Both gender-integrated and gender-strategic work are critical and have different implementation frameworks as well as different key players. My take therefore is that in both the biggest challenge is limited resources for implementation and differing implementation capacities if appropriately addressed will progress towards achieving gender equity.

15.2 The gender-integrated should be the first.

Annex 3.10.5 Candidate members of the Livestock CRP Independent Steering Committee

Name	Contact	Institutional affiliation	Gender	Expertise	Citizenship
Max Rothschild	Current Livestock and Fish CRP SPAC	Iowa State University	M	Genetics	USA
Maureen Miruka	Current Livestock and Fish CRP SPAC	CARE	F	Gender, social sciences	Kenya
Andy Peters	Current Livestock and Fish CRP SPAC	SRUC	M	Animal health	UK
Martin Webber	Current Livestock and Fish CRP SPAC		M	Value chain development	Canada
Muhammad Ibrahim	Muhammad.Ibrahim@iica.int	Director, CATIE, Costa Rica	M	Livestock Systems and Environment	Guyana
Fritz Schneider	Fritz.schneider@bfh.ch	Former Swiss College of Agriculture	M	Agriculture and livestock science, research for development	Switzerland
Martin Mitchell			M	Animal health	UK
Heather Burrow	Heather.Burrow@une.edu.au	University of New England	F	Quantitative Geneticist	Australia
Cao Thi Bao Van		Pasteur institute, Vietnam	M	Health	Vietnam

Annex 3.10.6 Terms of reference for the Livestock CRP Director

The CGIAR Research Program (CRP) on Livestock Agri-Food Systems seeks to sustainably increase the productivity of small-scale livestock systems to support food and nutrition security and poverty reduction, and enhance resilience of livelihoods. Led by the International Livestock Research Institute (ILRI), the CRP combines the strengths of 5 CGIAR centres and 2 non-CGIAR partners, as well as a range of collaborators from the research, development and private-sector communities around the world. Research will be undertaken in six priority countries (and some other locations) across Latin America, Africa and Asia.

The Livestock Agri-Food Systems CRP will be led and implemented by a Director, who will report administratively to the Director General of ILRI and programmatically to the CRP's Independent Steering Committee.

The CRP Director is responsible for:

1. Providing intellectual leadership by developing a clear shared vision of impact-oriented research for development for the Livestock Agri-Food Systems CRP among participating centers and other partners;
2. Managing the Livestock Agri-Food Systems CRP and ensuring that all program components are carrying out high-quality research and meeting their milestones;
3. Proposing Flagship and Country Coordination Leaders who are best qualified to realize the program's vision by implementing flagship activities and overseeing the work of flagship staff, liaising as needed with their home institution line management;
4. Coordinating the preparation of Livestock Agri-Food Systems CRP work plans, budgets, reporting, monitoring, and evaluation among participating centers and other partners;
5. Chairing the Livestock Agri-Food Systems CRP Planning and Program Management Committee (PPMC), which takes strategic management decisions regarding program implementation and makes recommendations to the ILRI Director General and the Independent Steering Committee (ISC) regarding CRP policies and priorities for funding and resource mobilization;
6. Chairing the Livestock Agri-Food Systems CRP Leadership Team, which manages the day-to-day implementation of the research program and makes recommendations to the PPMC on strategic research directions and management issues;
7. Developing and implementing program monitoring and evaluation systems and results-based management strategies to ensure the effectiveness of the program;
8. Supporting the Independent Steering Committee (ISC) in its interactions with the PPMC, the ILRI Director General and the ILRI Board of Trustees;
9. Managing the Performance Implementation Agreement with the CGIAR Consortium Board and the Program Partnership Agreements (PPAs) with participating centers and non-CGIAR partners;
10. Developing and managing partner relations among both the principal program partners and a range of other strategic research and development partners to ensure their optimal contribution to program objectives;
11. Promoting and facilitating cross-CRP collaboration that ensures the CRP portfolio is fully integrated;
12. Leading resource mobilization initiatives for major CRP-wide or cross-CRP proposals to bilateral donors to ensure the bilateral funding envelope is achieved with projects that directly implement the proposed CRP agenda;
13. Overseeing a communication strategy that builds internal ownership and external recognition of the CRP;

14. Ensuring gender, youth and capacity development are mainstreamed and embedded across all areas of the research program
15. Representing the Livestock Agri-Food Systems CRP to the CGIAR System Office, the CGIAR's Independent Science and Partnership Council (ISPC) and the Independent Evaluation Arrangement (IEA), and externally as needed; and
16. Managing the staff and budget of the Livestock Agri-Food Systems CRP Management unit.

Requirements:

1. PhD in a relevant discipline, including agriculture or social science;
2. At least 15 years of relevant experience, including an outstanding record in research leadership and management, in an international, multi-disciplinary, and multi-cultural environment;
3. Proven strong expertise in leading and managing collaborative and cross-cutting research, especially with respect to multi-institutional research programs;
4. Familiarity with the current state of knowledge, policy, and practice across the Livestock Agri-Food Systems CRP research agenda as described in the CRP proposal;
5. Proven fund-raising record;
6. Strong leadership expertise and management skills;
7. Excellent interpersonal and communication skills;
8. Fluency in English with proficiency in other international languages desirable.

Annex 3.10.7 Communications

Communication, engagement and knowledge management are critical in the quest to transform livestock systems. They underpin the learning required to discover, adapt and deliver innovations. More specifically, they contribute to (1) the achievement of CRP outcomes at different scales; and (2) the sharing of program/flagship results to enhance visibility and demonstrate accountability. In this area, the CRP aims to:

- Support the delivery of development outcomes through livestock systems innovation, transformation and scaling – by the use of communication tools, methodologies and approaches, the facilitation of effective engagement and collaboration processes and platforms, the use of ICTs, and targeted national and regional dissemination and publishing of evidence and results. This area has a strong focus on connecting, linking, facilitating and informing key actors so that they co-create knowledge and take interventions to scale.
- Support the discovery of research solutions – by the curation, publication, sharing and communication of research data, outputs and evidence as international public goods, and their adaptation as needed for optimal local re-use in livestock system transformation. This area has a strong focus on organizing, publishing and aggregating knowledge to make it locally and globally accessible.
- Support the development of sustainable livestock systems – by communicating evidence and results and engaging with key stakeholders to achieve wider influence and investment in sustainable livestock systems, locally and globally. This area has a strong focus on influencing decision makers and other audiences; it also packages and communicates science messages to wider audiences.
- Support the effective delivery and management of the program – through the use of tools and processes to support internal communication, collaboration and learning and accountability as well as planning, reporting, messaging and knowledge management. This area has a strong focus on internal program effectiveness as well as synthesizing learning and messages from across the program to influence different target audiences.

Implementing communication, engagement and knowledge management

Communication and engagement activities at program and flagship levels will:

- 1) Support partnerships and policy processes so that results and technologies are scaled and likely to deliver development impact (Elements 1, 2 and 4 of the guidelines).
- 2) Communicate about the program, the science, results and progress towards achieving targets (Element 3 of the guidelines)
- 3) Promote and facilitate learning and sharing to improve program effectiveness and collaboration (Element 5 of the guidelines)
- 4) Make CRP information, data and intellectual assets open and accessible (Element 6 of the guidelines).

They will further:

- 5) Enhance gender, capacity development and monitoring and evaluation activities at all stages of the CRP impact pathway
- 6) Communicate evidence and results and engage key stakeholders to achieve wider influence and investment in sustainable livestock systems, locally and globally.

At the program level, the CRP will:

- Invest in a mix of communication and collaboration tools, methodologies and approaches, including event and process facilitation, to connect, link, facilitate and inform key actors at priority research sites so they co-create knowledge and take interventions to scale. Building on Livestock and Fish CRP experiences, the program will ensure that local actors are supported with communication and facilitation expertise, and that local projects, innovation platforms, events, and policy interventions are well documented and the results communicated to research, development and policy communities. The program will recruit in-country expertise, devise standard workflows and use accessible sharing platforms supported across the CRP. Example investments are: the CRP website, stakeholder consultations, collaboration spaces, document repository, multi-media video, photo and audio products, articles and reports, posters, social media and blogs, participatory communication and mobile applications, research and policy briefs, extension and training materials, media awareness, workshops, and capacity development in all of these.
- Invest in platforms and tools to make CRP information products open and accessible. The program will ensure that all research outputs (unless specifically restricted) are properly archived, curated and accessible through open access repositories and associated policies that contribute to CGIAR's wider evidence base. The program will build on this accessibility, further generating, synthesizing and presenting data and knowledge in novel ways that increase their value and stimulate their use by different target audiences and stakeholders. This includes publishing research data, outputs and evidence as international public goods, and their adaptation as needed for optimal local re-use in livestock system transformation. Example investments are: CGSpace information products repository, *Tropical Forages* open access journal, open 'social' publishing platforms, data repositories in centres, creative commons product licenses, standard 'CG core' taxonomies to enable interoperability, software codes documented and deposited in GitHub
- Invest in products, approaches and tools that communicate evidence and results and encourage key stakeholders to achieve wider influence and investment in sustainable livestock systems, locally and globally. This communication about the program and its science also contributes to reporting and demonstrating progress towards targets. Building on products from other communication investments, the program will synthesize, package, report and disseminate information from across the flagships and sites, customizing products for different purposes and audiences. Example investments are: CRP website, opinion pieces in global research and development channels, media events and campaigns, joint advocacy, policy briefs, news stories, brochures, film documentaries, infographics, social media and blogs, conferences, 'flagship' core agenda products, and evidence briefs.
- Invest in platforms and processes that facilitate learning and sharing to improve program effectiveness and collaboration. The program will support internal communication, collaboration and learning, and accountability. The key focus here is on internal program effectiveness as well as synthesizing learning and messages from across the program to influence different target audiences. Part of this entails working towards a culture of inclusive, open and shared research in which program partners and collaborators can easily follow, contribute to, and draw on the collective knowledge of all program participants. This open science contributes to the program's value-for-money proposition, motivating collaborators and staff to value, engage, contribute to and enrich the program's efforts. Example investments are: Collaboration spaces, learning workshops and events, Most Significant Change documentation, participatory communication and video, social learning, facilitated review and planning meetings, outcome stories, learning briefs, and case studies.

The flagships will use a similar portfolio of communication investments, tailored to their specific audiences and needs:

- The local 'delivery' projects of the flagships will use and contribute to the same CRP-wide mix of communication and collaboration tools, methodologies and approaches to co-create and co-adapt knowledge and take interventions to scale. The three technology and the environment flagships will have a dedicated sub-set of communication, engagement and knowledge management activities, with budgets allocated for their specific requirements. In addition, the livelihoods flagship will have a strong focus on the scaling up of research and innovations. To pursue this, the program will draw on local expertise to support advocacy, awareness, engagement, collaboration, publishing and curation activities targeted to the local context. This expertise will enhance the research process and cross-partner collaboration, support the translation of outputs to outcomes, help build a favourable policy environment for uptake and scaling up, support planning, monitoring, evaluation and learning, and help build the ownership and buy-in that are necessary to scale up interventions. In all sites, effective engagement with partners and stakeholders is critical and will be supported through facilitation, collaboration and open communication and knowledge management.
- The flagships will use the program's platforms and tools to make their information products open and accessible. Depending on the flagship focus and partners, and the cycle of projects, the emphasis within flagships and clusters will fit within a continuum of informal to formal products and local to global public goods to be published, curated and made accessible. 'Upstream' research outputs will tend to be made available through formal channels and will thus be easier to make globally accessible; while in-country and site-specific outputs are likely to be more informal, requiring special efforts to make sure they are captured and made locally and globally accessible. The main budget line for flagships is likely to focus on open access payments for articles and books.
- The flagships will draw on and contribute to the products, approaches and tools of the CRP to communicate their evidence and results and engage with key stakeholders to achieve wider influence and investment. Each flagship will have its own set of high-profile products and results and each will budget to ensure these are properly and professionally communicated. They will draw on expertise from centres and partners. The CRP will support greater investment in products that have CRP-wide or wider significance.
- The flagships will use the program's investments in platforms and processes that facilitate learning and sharing to improve program effectiveness and collaboration. Within these, flagships are likely to want dedicated platforms, spaces or expertise to suit their specific needs; these will be budgeted within the flagships and form part of the wider learning infrastructure.

To deliver these activities, the Program will draw on expertise and resources in the strategic partners, so that messages are relayed widely to different target audiences and expert skills are mobilized across the program. The program will also develop and mobilize expertise in target countries to help animate and document the actions and evidence of local partners and stakeholders and to target products to local opportunities.

Budget and resources

Over time, bilateral projects will properly budget for communications, knowledge management and engagement activities and products. The CRP will also invest in key CRP-wide initiatives, activities and platforms necessary for the whole to exceed the sum of the parts. These include, for instance, a CRP website, CRP workspaces and support for collaboration, process and event facilitation, publishing platforms and series, media and advocacy expertise and networks, shared contacts/mailling lists, social media channels, etc.

Each flagship has budgeted for these activities to suit their pipeline of activities and to cater for major local or global milestones or engagement processes that require targeted efforts. Some have greater need for upstream 'science' communication, others for more engagement with partners or inputs into policy processes. Some will generate important CRP-wide products cutting across flagships – and indeed other CRPs – as part of their core and cross-cutting agendas and these will be supported from the CRP.

These activities will be guided from within the central CRP management function, which will also act as a supporter and catalyst to improve communication across the CRP and beyond as theories of change require. As elsewhere in the CRP, it will be important to tap into the varied and complementary expertise and influence pathways of partners. Resources to support these activities include:

6. Staff within the management unit for general coordination, oversight and CRP level communications (1.5% FTE)
7. Variable staff time within each flagship for specific communication needs
8. Staff time in strategic partners and in-country, paid from different sources (for example, the Livestock and Fish CRP has approx. 3 nationally recruited FTE at the country level; we expect this to increase so each priority country has its own dedicated support)
9. Dedicated budgets in flagships and at CRP level to produce different products, widely disseminate important messages, or engage in important events
10. CRP and flagship level funds under open access for open journal articles
11. Costs for communication budgeted in bilateral projects

The table below gives an overview for intellectual assets, open access, research data management and communication across the CRP. Given synergies among them, these items were planned and budgeted together in this proposal, and will be managed and reported together in the future.

Budget estimates for intellectual assets, open access, research data management and communication in the Livestock CRP (For 2017-2022, assumes 5% growth held constant at CRP and across all FPs and sources of funding)								
Year 1 - 2017	Total CRP/Flagship	of which...	IA	OA	OD	Comms	All	% total
Livestock Genetics flagship	\$10,549,446		\$ 2,400	\$ 30,000	\$ 193,892	\$ 51,400	\$ 277,692	2.6%
Livestock Health flagship	\$7,970,185		\$ 2,400	\$ 30,000	\$ 40,000	\$ 36,000	\$ 108,400	1.4%
Livestock Feeds and Forages flagship	\$6,598,000		\$ 2,400	\$ 23,200	\$ 32,000	\$ 35,000	\$ 92,600	1.4%
Livestock and the Environment flagship	\$5,305,958		\$ 2,087	\$ 20,870	\$ 17,391	\$ 61,739	\$ 102,087	1.9%
Livestock Livelihoods and Agri-food Systems flagship	\$8,134,718		\$ 2,400	\$ 24,000	\$ 50,400	\$ 24,000	\$ 100,800	1.2%
Sub-total Flagships	\$ 38,558,307		\$ 11,687	\$ 128,070	\$ 333,683	\$ 208,139	\$ 681,579	1.8%
Management & cross-cutting budget	\$2,408,620		\$ 48,000	\$ 54,000	\$ 90,000	\$ 217,900	\$ 409,900	17.0%
Strategic Investment fund	\$ 2,533,074		\$ 11,399	\$ 11,399	\$ 11,399	\$ 11,399	\$ 45,595	1.8%
Total	\$ 43,500,001		\$ 71,086	\$ 193,469	\$ 435,082	\$ 437,438	\$ 1,137,074	2.6%
Entire Program - 2017 - 2022	Total CRP/Flagship	of which...	IA	OA	OD	Comms	All	% total
Animal Genetics flagship	\$ 71,756,412		\$ 16,325	\$ 204,057	\$ 1,318,836	\$ 349,618	\$ 1,888,837	2.6%
Animal Health flagship	\$ 54,212,503		\$ 16,325	\$ 204,057	\$ 272,077	\$ 244,869	\$ 737,327	1.4%
Animal Feeds and Forages flagship	\$ 44,879,021		\$ 16,325	\$ 157,804	\$ 217,661	\$ 238,067	\$ 629,857	1.4%
Livestock and the Environment flagship	\$ 36,090,664		\$ 14,196	\$ 141,956	\$ 118,292	\$ 419,943	\$ 694,387	1.9%
Livestock Livelihoods and Agri-food Systems flagship	\$ 55,331,643		\$ 16,325	\$ 163,246	\$ 342,816	\$ 163,246	\$ 685,633	1.2%
Sub-total Flagships	\$ 262,270,242		\$ 79,494	\$ 871,121	\$ 2,269,683	\$ 1,415,743	\$ 4,636,041	1.8%
Management & cross-cutting budget	\$ 16,383,223		\$ 326,492	\$ 367,303	\$ 612,172	\$ 1,482,137	\$ 2,788,104	17.0%
Strategic investment fund	\$ 17,229,748		\$ 77,534	\$ 77,534	\$ 77,534	\$ 77,534	\$ 310,135	1.8%
Total	\$ 295,883,214		\$ 405,986	\$ 1,238,424	\$ 2,881,855	\$ 2,897,880	\$ 7,424,145	2.5%

Annex 3.10.8 References

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Annex 3.10.9 Acronyms

A4NH	CGIAR Research Program on Agriculture for Nutrition and Health
AFRISA	Africa Institute for Strategic Animal Resource Services and Development
AFZ	Association Française de Zootechnie
APAARI	Asia-Pacific Association of Agricultural Research Institutions
AnGR	Animal genetic resources
AMR	Anti-microbial resistance
APR	Anti-parasitic resistance
AR4D	Agricultural research for development
ARS	United States Department of Agriculture, Agricultural Research Service
ASF	African swine fever
ASARECA	Association for Strengthening Agricultural Research in Eastern and Central Africa
AU-IBAR	African Union Interafrican Bureau for Animal Resources
Beca	Biosciences for east and central Africa-ILRI Hub
BDS	Business development services
BRAC	Bangladesh Rehabilitation Assistance Committee
CAADP	<i>Comprehensive Africa Agriculture Development Program</i>
CCAFS	CGIAR Research Program on Climate Change, Agriculture and Food Security
CCARDESA	Centre for Coordination of Agricultural Research and Development for Southern Africa
CBPP	Contagious Bovine Pleuropneumonia
CCAFS	CGIAR Research Program on Climate Change, Agriculture and Food Security
CCEE	CRP-commissioned external evaluation
CCPP	Contagious Caprine Pleuropneumonia
CIAT	International Center for Tropical Agriculture
CIRAD	Centre de coopération internationale en recherche agronomique pour le développement
CL	Cluster leader
CoP	Community of practice
CORAF	West and Central African Council for Agricultural Research and Development
CRP	CGIAR Research Program
CSIRO	Commonwealth Scientific and Industrial Research Organisation
CTLGH	Centre for Tropical Livestock Genetics and Health
CTTBD	Centre for Ticks and Tick-borne Diseases, Malawi
DALYS	Disability Adjusted Life Years, a measure of the impact of disease.
ECF	East Coast fever
ELISA	Enzyme-Linked Immunosorbent Assay
EMBRAPA	Brazilian Agricultural Research Corporation
FEAST	Feed Assessment Tool
FAO	Food and Agriculture Organization of the United Nations
FARA	Forum for Agricultural Research in Africa
FL	Flagship leader
FMD	Foot and Mouth Disease
FTA	CGIAR Research Program on Forests, Trees and Agroforestry
GALVmed	Global Alliance for Livestock Veterinary Medicines
GEC	Global Environmental Change
GHG	Greenhouse gases
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit
GTA	Gender-transformative approaches
HIT	Heifer International Tanzania
HPAI	Highly Pathogenic Asian Avian Influenza A

IA	Intellectual assets
IBERS	Institute of Biological, Environmental and Rural Sciences, Aberystwyth University
ICAR	International Committee for Animal Recording
ICARDA	International Center for Agricultural Research in the Dry Area
ICRAF	World Agroforestry Centre
ICT	Information and Communications Technology
IDO	<i>Intermediate development outcomes (of the CGIAR)</i>
IIASA	International Institute for Applied Systems Analysis
ILRI	International Livestock Research Institute
ILVAC	ILRI's vaccine platform
IPG	International public goods
ISC	Independent steering committee (of the CRP)
IWMI	International Water Management Institute
ISPC	Independent Science and Partnership Council (of the CGIAR)
IUCN	International Union for the Conservation of Nature
JIRCAS	Japan International Research Center for Agricultural Sciences
KIT	Royal Tropical Institute, Netherlands
LAMP	Loop Mediate Isothermal Amplification
LDC	CGIAR Legumes and Dryland Cereals Agri-food Systems research program
LSMS	Living Standards Measurement Studies
M&E	Monitoring and Evaluation
MEL	Monitoring, evaluation and learning
MELIA	Monitoring, Evaluation, Learning and Impact Assessment
MOU	Memorandum of understanding
NAADS	National Agriculture and Advisory Services, Uganda
NAMA	Nationally Appropriate Mitigation Actions
NARS	National Agricultural Research Systems
NIRS	Near infrared spectroscopy
OA	open access
OIE	World Organization for Animal Health
PES	Payment for Environmental Services
PICO	Institute for People, Innovation and Change in Organizations
PIM	CGIAR Research Program on Policies, Institutions, and Markets
PIM table	Performance indicator matrix table (of the proposal)
PPP	Public-private partnership
PPR	Peste des petits ruminants
RDM	Research data management
RPA	Recombinase polymerase amplification
RTB	CGIAR Roots, Tubers and Bananas Legumes Agri-food Systems research program
RVF	Rift Valley fever
SALT	Sloping agricultural land technology
SARS	Severe Acute Respiratory Syndrome
SASI	Systems Analysis for Sustainable Innovation
SDG	Sustainable development goals
SLO	System level outcomes (of the CGIAR)
SLU	Swedish University of Agricultural Sciences
SME	Small- and medium-scale enterprises
SNV	Netherlands Development Organization
SoFT	Selection of Forages for the Tropics
SRF	Strategy and Results Framework (of the CGIAR)
SUA	Sokoine University of Agriculture

Sub-IDO	sub-intermediate development outcome (of the CGIAR)
TBD	Tick-borne diseases
ToC	Theory of Change
ULB	Université libre de Bruxelles
USDA	United States Department of Agriculture
VC	Value chain
VCD	Value chain development
VEDCO	Volunteer Efforts for Development Concerns, Uganda
VCTS	Value Chain Transformation and Scaling
WLE	CGIAR Research Program on Water, Land and Ecosystems
WUR	Wageningen University and Research Centre

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Annex 3.10.11 Livestock CRP responses to ISPC comments on pre-proposal

The Livestock Agri-Food Systems CRP received a number of helpful comments from the ISPC in its review of the pre-proposal, which were shared with the proponents in September 2015. These were incorporated into revisions, with the 'C' rated portions of the CRP resubmitted to the ISPC in mid-December 2015. ISPC provided further comments on the revised sections.

In the tables below, the CRP responses to the summarised comments from ISPC on the revised pre-proposal sections are first listed. This is followed by the table of responses to the ISPC comments provided in September 2015. In this instance, the initial responses are described as 'Previous:' with a subsequent, short update provided relating to both the responses to the ISPC comments provided in January 2016 (referred to as 'Update:') and the final revisions and developments that are reflected in the full proposal now being submitted.

ISPC comments on re-submitted sections of pre-proposal, January 2016

ISPC January 2016	Response/action
<p>The full proposal should address the current contradictions in the narrative and provide a more convincing (and better referenced) justification of the CRP's chosen approach, to give confidence that the research questions being addressed are the priorities for delivery of the stated outcomes. In its current form, the CRP has not yet provided an evidence base to support that "having a research agenda that focuses on increasing livestock productivity in the smallholder sector and enhancing resilience of livestock-related livelihoods is the best option for livestock to contribute significantly to all three System Level Outcomes".</p>	<p>These dimensions have been strengthened in the overall narrative. Key references have been added together with a number of hyperlinks, bearing in mind the space limitation. The proposal has articulated the potential of the livestock sector in relation to 'groups' of SDGs which combine aspects from several analyses and consultations beyond the proponents of the CRP. In the TOC the impact pathway for contribution to each of the SLOs has been described.</p>
<p>The analysis of sector dynamics is still unconvincing and needs to have a crisper narrative avoiding contradictions and improving the strength of its evidence (including appropriate references) to support its generalisations. This, combined with an objective analysis on how livestock sector dynamics could best contribute to the attainment of the SLOs, would provide a convincing basis to further develop the role of CGIAR livestock research in contribution to the SLOs.</p>	
<p>In its ToC section, the CRP defines the problem in terms of rising demand for animal source foods and a need for dietary quality among the poor, but the solution set remains unconvincing when that is the specified goal. Further clarification of the proponents' assumptions and additional detail on how its current activities on system characterization/description, discovery and localised delivery of research outputs will contribute to impact at scale would make these sections more compelling</p>	<p>The ToC narratives and diagrams for the overall CRP and for each flagship have been re-worked, describing impact pathways to SLOs, assumptions and enablers. Potential for international and local public goods is described for the CRP as a whole.</p>
<p>The identification of the CRP's research priorities will need to move beyond the stipulation of very broad research areas in the resubmitted pre-proposal sections, and to be accompanied by a systematic assessment of priorities. Further reflection is also required on its largely producer-focused agenda when most of the justification for a focus on animal-source foods is based on consumer demand. The link between those two positions, with smallholders as 'the solution', needs to be made more convincingly</p>	<p>Noting that the livestock sector that the CRP seeks to address covers multiple commodities and systems, the CRP has articulated the framing of broad research areas in the overall narrative. These are then translated into priority research areas (the flagship topics) in section 1.2. Whilst the technology drivers of productivity are prominent, it is noted that each flagship has specific work on delivery of those specific technologies and the equitable business opportunities that can be explored around these (eg seed production, vaccine delivery). 'Adding together' the solutions for productivity is framed in a livelihoods and nutrition context through the work of the Livestock Livelihoods and Agri-Food Systems flagship.</p> <p>Whilst empirical studies on the relationship between increased productivity and greater consumption of animal-source foods are scarce, those that have been undertaken show both direct and indirect benefits of increased animal productivity for better household nutrition. The CRP bases its production-consumption link on two dimensions, related to the widely used definition, dating back to the World Food Summit in 1996, is that food</p>

	<p>security exists when all people, at all times, have physical and economic access to sufficient, safe, and nutritious food that meets their dietary needs and food preferences for an active and healthy life (see http://www.who.int/trade/glossary/story028/en/). It thus considers the following:</p> <ul style="list-style-type: none"> - Abundance of animal-source foods from greater productivity will lead to greater availability of food, and with improved supply to lower prices. - Improved access to animal source food for many rural producers means they will have the opportunity to consume more of such nutritious foods. Despite the limited evidence, this is a testable hypothesis. <p>The Livestock Livelihoods and Agri-Food Systems flagship addresses dimensions of consumption, through its integrated work to enhance access to animal source foods by poor urban and rural consumers. Including deliberate research in this area, spanning a range of market, policy, institutional and equity aspects is intended to address the ‘gap’ that can occur between increased production and improved access and consumption. In sum, it should be clearer that the CRP is not intending to address consumer demand as such, but rather to improve the competitiveness (productivity) and professionalism of smallholder systems to ensure the ongoing response to increased demand is more inclusive than otherwise would be the case, with benefits to both poor producers and especially poor consumers.</p>
The gender narrative in the submitted pre-proposal sections, albeit well referenced, would benefit from ironing out contradictions. Clarification on how the CRP will achieve its stated gender objectives with an agenda that currently seems to be skewed towards analysis and characterization only, and how the CRP’s understanding of gender has shaped its research agenda, beyond the testing of CRP-developed technologies on gender, would also help.	The gender narrative and the related annex have been re-written, to better balance the proposed agenda and indicate how gender dimensions have, to date, shaped the research proposed.
Descriptions of comparative advantage need to be more analytical, specific, and better linked to the CRP’s priority research areas. In addition, claims that no one else does research across issues linking livestock with, say, environment or nutrition, require further specification.	The section on partnerships and comparative advantage has been re-written to take account of the issues raised. The CRP recognizes there are many others undertaking different aspects of the research, and aims to connect and build upon these, recognizing the strengths of different partners.
The specific role of the Livestock Livelihoods and Agri-food Systems Flagship within the CRP and links with other Flagships need further elucidation. In addition, the decision to maintain the Livestock and Environment Flagship as a stand-alone Flagship, rather than integration into the activities of the other Flagships, needs a stronger justification	<p>The Livestock Livelihoods and Agri-Food Systems flagship plays a key role in ‘adding together’ results from the technology and environment flagships in the context of improving livelihoods including nutrition, resilience and promoting pro-poor livestock innovations (understanding market contexts and consumer demand, engagement of women and youth in business) that improve the sustainable performance of animal-source food systems.</p> <p>The Livestock and the Environment flagship has articulated the rationale for ‘Why should the CGIAR invest?’, and the ex ante impact assessment indicates that within the</p>

	flagship work on GHG emissions is particularly important, with the flagship being an important component of the overall portfolio.
The section on partnership has improved significantly in explaining how some partners were chosen. It would be further strengthened, however, by additional details on key national and regional partners, and decisions on Flagship leadership. More detail on how the CRP will link its development and testing of foundational science and practice to global multi-stakeholder initiatives critical to knowledge application, systemic change, and impact at scale, will also be required in the full proposal.	The CRP addresses partnership dimensions in many places in the proposal. The overall approach is set out in the CRP narrative, with further topic-specific partnerships mentioned (largely as examples) in each flagship narrative. The partnership strategy in the annex addresses these concerns directly by describing three major partnership challenges set by CRP recognizing the need for new and different partnership modes and arrangements. Further detailed examples (not a comprehensive list) are presented in the annex.
The sections submitted provide little additional detail on inter-CRP collaboration, and the specific roles of the GI-CRPS within the Livestock Agri-food systems CRP. More detail on the strategy and practicalities of such integration, and how it will enable this CRP to enhance its contribution to the SLOs would strengthen the full proposal.	The appropriate annex and tables have been completed to articulate the details of cross-CRP collaboration. The information presented is based on specific discussions with CRPs on the research to be undertaken, and its location. In many instances seed funds (from the management budget strategic investment fund) will be used to engage with partners and co-create opportunities for raising new resources for the joint agendas.
The leadership, management and governance sections need to indicate awareness that a focus on livestock only may not be the most effective way forward: Addressing today's (and tomorrow's) grand challenges needs a broad view of the world. Clarification of the relative responsibilities of the different committees and units would be required. In relation to the appointment of the CRP director, experience in managing multi-institutional research programmes and leadership expertise should be the overriding selection criteria	Adjustments have been made to the leadership and management section responding to this guidance. The place of the CRP in relation to other partners and indeed other CRPs is addressed in the relevant sections of the proposal. ToR for the director have been adjusted.
Whilst the section on target sites has improved, presence of the CRP in a specific location alone should not be equated with site integration. Details of the expected added benefits of working on the same sites as other CRPs will be expected in the full proposal. Moreover, whilst the introduction to the resubmitted sections suggests that the revised text clarifies how the balance between international public goods and site specific research and development outcomes has been redressed, limited additional detail on this is provided. The ISPC thus recommends that this is strengthened in the full proposal prior to its submission in March.	The annex on site integration provides information on the engagement of the CRP in this regard, which is also touched upon in the cross-CRP descriptions. Distinctions, of the types of international and local public goods the CRP strives for are articulated in the ToC in the CRP narrative.

ISPC comments on pre-proposal, September 2015

ISPC COMMENT	RESPONSE
MUST-HAVES	
<p>#1 The analysis of sector dynamics, ToC, impact pathways, targets, and budgetary allocations need revisiting. Lots of facts about livestock are given but they need to be presented in a logical manner to define where CGIAR research can add most value</p> <p>From Summary:</p> <ul style="list-style-type: none"> • ...justification provided by the CRP for its sole focus on smallholders is not convincing... absence of a convincing analysis of sector dynamics linked to research opportunities and outcomes that support the attainment of the SLOs • Translating a clear understanding of the sector's evolution into a ToC (with convincing hypotheses and assumptions), and impact pathways at the CRP and FP level could provide the additional clarity in focus and activities needed. This conceptual clarity is not only required in respect of the proposed research, but also in respect to the achievement of impact at scale. 	<p>Updated response given above.</p> <p><u>Previous:</u> The presentation of the Theory of Change, targets and budgetary allocations can certainly be strengthened. However, we feel the pre-proposal does provide a credible analysis of sector dynamics by presenting facts describing the broad range of drivers and pressures influencing the evolution of the sector and the predominance of smallholder production in many contexts, and then synthesizing this information, first, in the form of scenarios to highlight the opportunity and need for small-scale production to respond to the rapidly increasing demand for animal source food and enhanced resilience, and second in the form of trajectories to capture the range of challenges in enabling such a response. We did not sufficiently highlight that these were developed in consultation with a range of stakeholders at national, regional and global level during the development of the ILRI strategy in 2012-2013.</p> <p>The contribution that CGIAR research can make within this context is explained and informs the proposed research agenda. The ISPC challenges this logic, noting that "its sole focus on smallholders is not convincing". We would ask for more clarification to correctly interpret this criticism. At face value, the CRP's primary focus on smallholders (as a general term for smaller-scale production and market systems) is simply respecting the SRF mission statement "...to enable poor people, especially poor women to increase agricultural productivity and resilience; share in economic growth and feed themselves and their families better,..." While we acknowledge the need to consider these producers in the context of the broader trends in the livestock sector, we understand that our focus is consistent with the SRF. We also understand our reasoning for focusing on smaller-scale systems to be supported by the findings of the ISPC study of the future of small-scale agriculture which projected that small scale agriculture will continue to dominate the sector for some time to come, especially in Africa. Another interpretation would be this perspective echoes the long standing debate about the best approach to livestock development, with some actors understandably more oriented to implementing a sectoral approach in which the formal, larger scale subsector is given priority, whereas the CGIAR's comparative advantage is to focus its research to support inclusive and sustainable livestock development, and hence concentrates its attention on smaller scale and often informal production and market systems. Yet another interpretation would be that the reference to its 'sole' focus suggests that the CRP is ignoring the role that private sector can play in supporting increased access to inputs and markets. This is certainly not our intention and we will explain this more clearly in the proposal. We certainly appreciate that we work within and must appreciate the sectoral context, and that our impact pathways need to</p>

	<p>involve a range of partners from the larger-scale, formal sector—and that these vary according to commodity, e.g. dairying but we remained convinced that maintaining our focus on the central challenge of growing inclusive, sustainable livestock production and marketing systems—which mainly fall under the smallholder category-- as part of the transition to more professional agri-business and, for many, the transition out of agriculture, is consistent with the SRF.</p> <p>Given the complexity of livestock systems, the diversity of commodities and the multiple roles that livestock play, it has certainly been challenging to develop a single theory of change for the whole CRP. There will be multiple ways in which the proposed research can contribute to transforming the livelihoods of poor livestock producers and consumers. Nevertheless we accept that we can articulate better a theory of change for parts of the livestock sector that are on different development trajectories. We will do this by emphasizing more clearly the range of opportunities offered by livestock from accelerating appropriate intensification at one end of the spectrum and from protecting and enhancing the role they can play in household and community resilience at the other, with most contexts actually lying on the spectrum between them, with a mix of both aspects.</p>
#2 The CRP needs to select its priority research opportunities based on the SRF, its comparative advantage, the opportunity to link with other CRPs and its global remit	<p>Updated response above.</p> <p><u>Previous:</u> We accept that the explanation can be strengthened regarding the selection of the CRP's priority research based on the SRF, its comparative advantage, the opportunity to link with other CRPs and its global remit, but would seek clarification whether the ISPC concluded that the priorities identified are inconsistent with these. The proposed research in FPs is all clearly mapped to sub-IDOs, and much of it has been repeatedly endorsed as long-standing critical research priorities at national, regional and global level. At the same time, the increased attention given to environment, human nutrition, gender and youth demonstrates that the agenda is responding to the SRF and which is also echoed in emerging national, regional and global priorities. And more specifically, the eight research priorities highlighted in the SRF are clearly reflected in how each of the FPs have been defined: (1) genetic improvement to increase production – Animal genetics and Feed & Forages FPs, which in livestock also requires attention to animal health to achieve genetic potential; (2) nurturing diversity in both animal and plant genetic resources – Animal genetics and Feed & Forages FPs; (3,4+5) agricultural systems, gender and inclusive growth, and nutrition and health— focus of the Livelihoods, Resilience & Nutrition FP; (6) enabling policies – also addressed by the Livelihoods FP and the new Priority Setting & Impact at Scale FP; (7+8) NRM and CSA – Livestock & the Environment FP. We agree that this alignment needs to be better documented in the proposal.</p> <p>Links with other CRPs: Initial discussions with other CRPs identified links which were presented as an annex as a result of discussions with other CRP leaders and focal points.</p>

	<p>These will be further elaborated in the full proposal (specific research questions related to FPs, locations etc.). We would highlight the innovative collaborative platform for improvement of nutritive value of crop residues which links most of the Agri-Food Systems CRPs.</p>
<p>#3 There is little specific justification of partners and few national and regional partners from developing countries are mentioned. The CRP needs to clarify its networking and partnership arrangements, roles and responsibilities on the basis of comparative advantage and subsidiarity</p>	<p>Updated response above.</p> <p><u>Previous:</u> We embraced the ISPC comments at the Bogor meeting about not wanting lists of hundreds of partners, but rather a description of the strategy for identifying partners. This was the spirit of the general strategy described in the main narrative, and with more detail given as examples of specific strategic partners relevant to the overall CRP and specific FPs. We seek clarification from ISPC on the balance they are expecting between strategy and lists. Given that the Livestock CRP is considerably different from the current L&F CRP, the partnership constellation will also be different and the short timeframe for the pre-proposal has not allowed the time needed to confirm some of the detail asked from the reviewers: this will be a high priority during the full proposal development stage and we will be more explicit in the expected outputs and outcomes from the partnerships.</p>
<p>#4 The CRP needs to clarify how its country vs. system focus is aided by CRP and site integration, and how this will be utilized to maximise IPG benefits across other countries and regions</p>	<p>Updated response above</p> <p><u>Previous:</u> We would like clarification on what the ISPC means by country vs system focus. We interpret it to refer to the balance between delivering on the needs of specific country (essentially local public goods) versus system needs to generate IPGs. If so, this is a tension that is likely to become even more an issue for the System as Site Integration is implemented. From our perspective, this should be straightforward and also explains part of the original rationale for a Transformation & Scaling FP, i.e. the other FPs work at a systems level across sites, generating IPGs, whereas the Transformation & Scaling FP is focused on understanding the context and research demand to inform the IPG agenda and understanding how the IPG results translate into local public goods and impact. These two dimensions are now embedded in each FP, with the Livelihoods FP taking responsibility for integrated packages designed for our target sites, and the Prioritization & Scaling FP looking at the processes of targeting and scaling across the FPs and sites. This is not dissimilar from how CRPs will work across sites for IPGs while contributing to Site Integration for LPGs and impact. We don't believe this tension has been adequately addressed at system level and look forward to engaging with ISPC on this. We acknowledge, though, that this interpretation may not have been sufficiently articulated in the pre-proposal.</p>
<p>Merge Feeds & Forages with Livestock & Environment</p> <p>(Note: This recommendation is presented under the individual FPs, but is brought up front as a major recommendation since it relates to the CRP structure.)</p>	<p>Update: For the reasons described earlier and resulting from discussions at the Rome meetings in late 2015, the CRP has retained separate flagships on Livestock Feeds and Forages and Livestock and the Environment. A clearer distinction between these two research areas as well as the relationship between them is articulated. Livestock feeding is a key component of improved productivity, which is one of a number of key research dimensions the CRP addresses to reduce the 'yield gap'. For reasons stated earlier, and subsequently endorsed by</p>

	<p>the reviews at the Rome meetings, the inclusion of a Livestock and the Environment flagship responds to the need to reduce the environmental footprint of livestock production while ensuring that livestock systems are able to adapt to global environmental changes.</p> <p><u>Previous:</u> Feeds and Forages and Livestock and the Environment FPs. We are not convinced by the argument to merge the Feeds and Forages FP with the Environment FP. From the Feeds and Forages viewpoint, while the feed and forage work has strong links to and implications for the environment, its main focus is on addressing the livestock ‘yield gap’ and so is primarily linked to the other FPs concerned with increasing livestock (and crop) productivity. The main objective of the FP is technology development and testing. We do recognize possible overlaps in the pre-proposal text, and in the revision of the FP we will clarify the focus on technology. Some of these technologies may have implications for environmental issues, e.g. adaptation to climate change through enhancing stress tolerance and mitigation of climate change through Biological Nitrification Inhibition. Environmental impacts and assessments of suitability of forages under environment change will be measured in the Livestock and environment FP.</p> <p>From the Livestock and Environment viewpoint we do recognize the need to clarify eventual overlaps in the pre-proposal between the two FPs. However, given the importance of livestock-environment interactions globally and the often distorted views of the role of livestock in developing countries in relation to the environment we believe that a FP with a strong focus on the environment is essential. Maintaining an environment FP also responds to the repeated comments to the current Livestock & Fish CRP from ISPC on the need for increased visibility of a dedicated environment agenda within the CRP.</p> <p>In the revision we will clearly distinguish between the a) Livestock and Environment FP addressing livestock-environment interactions at the systems level and b) the Feeds and Forages FP focusing on technology development.</p>
<p>Integrate Transformation & Scaling back into other FPs</p> <p>(Note: This recommendation is presented under the individual FP, but is brought up front as a major recommendation since it relates to the CRP structure.)</p>	<p>Update: The CRP does not include a flagship on this topic in the current revision. The Livestock Livelihoods and Agri-Food systems flagship covers areas including targeting, prioritizing, integrating and piloting, in the context of maximizing livestock related livelihoods and resilience.</p> <p><u>Previous:</u> We agree that Transformation & Scaling FP lacked a certain coherence. We are proposing to replace it with a new FP with a far clearer function, a clear research agenda and a vital integrative role for the CRP as a whole. This involves integrating certain components from the original Transformation & Scaling FP to other FPs, but retaining and strengthening the role of others. Specifically, clusters on a) integration of technical and institutional innovations into intervention packages and b) research on gender and youth will be moved to the Livelihood, Resilience and Nutrition FP given its agri-food and livelihood systems</p>

	<p>perspective. The new “Priority Setting & Impact at Scale” FP, highlighting its focus on guiding the CRP’s research agenda towards achieving impact at scale; placing smallholder production and the consumption of animal-source foods by poor people in the context of broader sector trends; ensuring that CRP research results in integrated solutions by analyzing trade-offs and synergies among socio-economic, environmental and public health outcomes; and tracking how our research will bring about progress towards SRF targets through our theory of change. GIZ and WUR remain strategic partners for the science of impact, with clarification that GIZ is not our preferred partner simply to implement scaling-out activities – the CRP will collaborate with and backstop a range of partners for such activities – but rather because they are interested in contributing to research on the research-development interface and the science of impact; bringing their particular development experience and perspective.</p>
Summary	
1. Overall analysis as an integral part of the CRP portfolio [Score: B]	
<p>The scenarios, challenges, and trajectories presented in the CRP appear to be focussed on justifying an emphasis on smallholders only, rather than providing an analysis as to how the sector can best contribute to the SLOs. In addition, whilst the selection of the FPs (FPs) is aligned with the outcomes specified in the SRF, the role that the presented (and possibly other) analyses played in the conceptualisation of the proposed research, the definition of outcomes, and the allocation of resources needs elucidation. The CRP thus needs to present a more compelling analysis of sector dynamics that links its selection of research opportunities to outcomes that support the attainment of the SLOs</p>	<p>Updated response above</p> <p><u>Previous:</u> As discussed above, with clarification from ISPC on the comment on the smallholder focus, the logic of the research agenda will be strengthened.</p>
<p>Whilst the integration with other CRPs is mentioned and presented in an annex, further detail, particularly with respect to the functional integration with A4NH and PIM, is required. More information is also required on the nature of other proposed partnership arrangements, and how well the institutional priorities of these partners align with those of the CGIAR and this CRP.</p>	<p>Update: see above and the relevant annex and associated tables in the proposal submission.</p> <p><u>Previous:</u> We have commented on and sought clarification on the matter of how partnerships should be dealt with (see response to #3 above). Also as noted above, given that the Livestock CRP is considerably different from the current L&F CRP, the partnership constellation will also be different and the short timeframe for the pre-proposal has not allowed confirming some of the detail asked from the reviewers: this will be a high priority during the full proposal development stage. Depending on the specific guidance provided for the development of the full proposal we envisage incorporating more information on the expected outputs and outcomes and sites for the cross-CRP collaboration and the modalities of collaboration and integration which includes joint resource mobilization on agreed common agendas.</p> <p>With respect to the program’s non-CGIAR partners--SLU, Wageningen and GIZ—in our consultations we have confirmed their strong alignment to the CGIAR and CRP goals, which is explicit in the case of the two universities in their re-positioning as global institutes with the intention to contribute more directly to development objectives. GIZ has a specific</p>

	development mission. This alignment will be documented and brought out more clearly in the full proposal.
The CRP strongly stresses the added value of a programmatic approach, but it is not apparent how the proposed 'Transformation and Scaling' FP (FP6) will deliver the CRP's added-value. This may be more easily achieved through additional coordination and integration of the other FP activities rather than through a stand-alone FP. In its current form, FP6 appears to duplicate many of the systems analysis, testing, and gender analysis functions already present in the other FPs. Moreover, whilst there are potentially interesting aspects to the partnership arrangement proposed in this FP, it currently seems to be focussed on pushing supply-side science delivered by other FPs through one preferred 'development' partner, rather than about experimentation with different ways of using research and partnership for impact.	<p>Update as above</p> <p>Previous: As noted above, we agree that the originally proposed Transformation & Scaling FP lacked coherence. We have dropped it as recommended, integrating certain components in the other FPs. A new FP is proposed to address priority setting and impact at scale for the CRP. We feel strongly that there is a need for this type of crosscutting FP to apply systems analysis and other methodologies to evaluate trade-offs, synergies, and to guide research priorities and guide development investments (which our partners often seek); to target CRP activities based on evidence and potential for impact; to monitor and evaluate outputs and to conduct the research that will facilitate the research outputs from the CRP resulting in impact, in terms of SRF development outcomes. We appreciate the comment regarding apparent duplication and have moved the gender work to the Livelihoods FP and the testing of interventions to both systems FPs (Livelihoods and Environment). In our re-design of this FP we have defined much more clearly the boundaries of systems analysis that sits within this FP versus that which sits in the technology and systems FPs.</p> <p>The comment regarding the impression that the FP was pushing supply-side science delivered by other FPs through one preferred 'development' partner has we hope been addressed through these adjustments.</p>
The scientific arguments and quality appear to be high in parts of the CRP, however, the focus and discussion on what actually will be done across clusters and FPs appears highly variable. In addition, whilst risks are undoubtedly changing and hence existing assessments may need updating, the currently proposed characterisation and systems analysis activities proposed in most FPs, appear to suggest a start from scratch rather than building on ILRI's (and many others) long history of livestock sector-related research.	<p>Update: Flagship narratives articulate the research priorities and locations as well as referring to previous work, including the Livestock and Fish CRP.</p> <p>Previous: For the technology FPs (animal health, genetics and feeds & forages), we are tightening up the focus by adopting a common framework to address the livestock 'yield gap'. This, together with strengthening the ToC and impact pathways in each FP will sharpen the focus and harmonize the quality better.</p> <p>We did not intend to give the impression that the systems analysis activities would be starting from scratch; we will certainly be building on the existing work. However, the research questions have clearly evolved, requiring new methods and types of data to address the more detailed targeting required for value chains, including better information about, and spatial disaggregation of, consumption and market trends, land use changes under climate change, competing enterprises, etc.</p>
Moreover, whilst there are some good examples of lessons learned from the LF CRP, explanation of those lessons remains in many places restricted to general descriptions on what has been done. Limited information is	Update: the Livestock Agri-Food Systems CRP will build on both the science and the lessons of 'integrated working in value chains' from the Livestock and Fish CRP. Work in a number of value chains will be continued, and the processes of systematic engagement developed

presented on how the proposed research agenda builds on, and will be shaped by, earlier results	<p>further to allow for integrated work when a particular value chain is not the focus – such as in the focus systems where in many cases improving resilience is a focus. References are made throughout the proposal to such opportunities.</p> <p><u>Previous:</u> Agreed: we will revise to highlight recent lessons learned, bringing in information that the reviewers may have missed in Annex 4 of the preproposal.</p>
2. Theory of Change and Impact pathways [Score: C]	
No ToC section is presented at the CRP level. The document does, however, include a ToC, generally without clear hypotheses, for each FP. The ‘Impact pathways and relationships of FP’ diagram that is presented is essentially a depiction of how the component parts of the CRP are said to fit together. It is thus difficult to judge how the CRP envisages that the FPs and their clusters complement each other towards the achievement of the presented overall CRP outcomes.	<p>Update: as above, ToC narratives and diagrams have been reworked at CRP and flagship levels.</p> <p><u>Previous:</u> The presentation of the ToC is being revised and strengthened to bring out the logic more clearly.</p>
A table of target beneficiaries lists expected outcomes against targets and sub-IDOs. Many of the key assumptions noted, however, are risks that should be internalized by the CRP. In addition, further clarity is required on how the postulated impact will be achieved through the currently proposed micro-level approaches of the ‘Transformation and Scaling’ FP. As presented, this FP has a fairly weak impact logic related to the systemic change that would be required to attain the proposed levels of impact.	<p>Update: As above, and describe here, the ToC narratives and diagrams have been reworked.</p> <p><u>Previous:</u> The ToC is being revised to highlight more clearly the spheres of control, of influence and of interest of the CRP, and this will provide a stronger basis for identifying the assumptions related to achieving impact at scale. The table of target beneficiaries at FP level will be updated accordingly with:</p> <ul style="list-style-type: none"> • Separation and clarity on key assumptions vs. external risks • Methodology for estimating targets explained and applied consistently across FPs • ‘Beneficiaries’ to cover the entire livestock system as appropriate (e.g. producers, consumers, other value-chain actors, land area etc.) <ul style="list-style-type: none"> ○ A program level table and text will be added to make explicit the contributions of these targets to the SRF (Table1 of CGIAR SRF document). ○ We view this target-setting process not as a one-off, stand-alone exercise, but rather as a core component of the priority setting and foresight, systems analysis and science of impact research areas going forward. These two-way interactions will be made elucidated to give clarity on how approaches in these research areas will translate to the proposed levels of impact.
3. Cross-cutting themes	
The CRP is clear in its understanding of the key role that women play in smallholder livestock production and thus the need to target them specifically. How this has influenced the selection of research topics or priorities in the CRP <i>per se</i> , however, is less clear. From the text it appears that the gender implications of technological and institutional solutions are proposed to be studied through a set of integrated research activities in FP6, after they have been designed, delivered and studied.	<p>Update: As above, the gender narrative and annex as well as the research in each flagship have been strengthened both in regard to the role of gender in achieving the CRP’s ambitions and in influencing priorities.</p> <p><u>Previous:</u> Phase 1 identified the need to more systematically assess gendered priorities in the CRP’s value chain sites and develop mechanisms to integrate them in the research agenda. However, insufficient reference was made in the pre-proposal as to how key strategic gender analysis, findings and outputs from phase 1 have influenced phase 2 research priorities in</p>

	<p>each FP. The significant progress and learning vis a vis gender integration in phase 1 and its influence on phase 2 research priorities will be better articulated, for example in reference to: a study on the meanings of ownership, gender transformative approaches, studies on gender norms, Women's Empowerment in Livestock index and outcomes from 16 specific activities supporting integration of gender analysis among non-gender specialists (gender mainstreaming).</p> <p>Despite strategic gender research outcomes and progress on gender integration, we acknowledge that more can be done in terms of systematically integrating gender into ex-ante analysis, and processes that inform research priority setting. In phase 2, the Priority Setting & Impact at Scale FP will include further research and development of gender integrated tools and methodologies for to inform both targeting and priority setting, as well as gender-integrated MEL. This builds on several ongoing phase 1 projects such as a targeting tool that maps gender contexts and the integration of gender into the Feed Assessment Tool (FEAST), which helps researchers to collect and analyze data related to local conditions and agricultural practices.</p>
<p>The enabling environment is not explicitly dealt with in the CRP overview, although it does get some attention in the FPs. Given that parts of the CRP do have a significant focus on facilitating policy and institutional change, the general lack of recognition of broader issues such as subsidies, security in pastoral areas, vested interest, and policy change process, requires attention. The apparent lack of conceptualisation of these issues suggests that not all FPs might have paid due attention to the complex enabling environments in their research plans.</p>	<p>Update: as above, flagships describe the opportunities and research issues for delivery of technological solutions and environmental options. Policy and institutional issues germane to the integration of solutions for improved sustainable and resilient livelihoods are addressed in the Livestock Livelihoods and Agri-Food Systems flagship.</p> <p><u>Previous:</u> As noted, attention to the enabling environment is strongest within the specific areas addressed by each FP, e.g. policies that determine veterinary service delivery options within the Animal Health FP; generating evidence on GHG parameters to influence global livestock and environment policy within the Livestock & the Environment FP. Addressing the broader agenda on the overall policy environment was an ambition in Phase 1 (though just limited to the L&F intensification subset within the overall livestock agenda), but was not achieved internally or through collaboration with PIM.</p> <p>The formulation of a Priority Setting & Impact at Scale FP is in part intended to provide a stronger platform for consolidating the work across the FPs and addressing the broader enabling environment, through both the systems analysis and the ToC work.</p>
<p>The CRP adopts the CGIAR CapDev framework and gives particular emphasis to the design and delivery of training materials and the training of future research leaders. More substance should be provided at this stage as to what will actually be done</p>	<p>Update: detailed capacity development sections – in the CRP narrative, annex and in each flagship are provided and all are developed based on the CapDev framework.</p> <p><u>Previous:</u> This is expected to be provided in the full proposal.</p>
4. Budget	

<p>The current request, at a level of c. USD 125 million per year with an overall expectation that 50% of this will be mobilized through W1/2, represents a fourfold increase over the ongoing L&F CRP. Given the lack of a compelling analysis of sector dynamics, there are significant concerns as to whether the CRP can actually deliver on its promises.</p>	<p>Update: initial budget ambitions have been superseded by the discussions and decisions in late 2015, leading to the guidance on budget envelopes in the call for proposals. The CRP has presented its research and budget in line with these requirements.</p> <p><u>Previous:</u> A justification for the increase level of investment compared to the L&F CRP was provided in the cover letter with the pre-proposal but this may not have been available to the reviewers. That cover letter is provided as an annex to this response. Two of the paragraphs that are relevant to the comment on budget are:</p> <p><i>After a history of being the Cinderella sector, this pre-proposal is the first step to livestock seeking to assert its rightful place on the CGIAR research for development agenda. Rightful, as livestock contributes 40% of agriculture GDP and is growing. Also, FAOSTAT figures for 2013 indicate that livestock commodities are four of the top five highest value agricultural commodities globally, with a total global value (2004-2006 international dollars) of \$679 billion. Almost a billion small holders in developing countries depend directly on livestock for their livelihoods and many, many more indirectly. The recognition that past agricultural research and development investment has not sufficiently delivered on nutritional security and the resulting increased emphasis on nutritional security in the SRF will require the CGIAR to increase the proportion of investment on this topic. A bold and transformative livestock research agenda is ideally placed to contribute here, as well as addressing poverty and food security in a sustainable manner.</i></p> <p><i>You will note that this pre-proposal, despite the absence of fish, is larger in breadth and scope, and proposed budget than the current Livestock & Fish CRP. There are several reasons for this: (a) the consolidation of the livestock agenda now scattered over at least 7 CRPs; (b) the agenda has been expanded to respond to the recommendations of the ISPC commissioned white paper on livestock; (c) the overall level of research and development effort required to be impactful has been significantly expanded as the livestock agenda in the current phase is regarded as underfunded, and (d) much larger efforts for (i) gender, (ii) capacity development (iii) M&E, data and RBM and (iv) communications and knowledge management are contemplated. However, you will be pleased to note in this submission that despite the consolidation of the livestock agenda referred to above, this program is strongly linked to other CRPs and so also anticipates the need for resources to co-finance and co-create research products with other agri-food systems CRPs, and the integrative ones (PIM, A4NH, CCAflagship, WLE) in which ILRI leads selected FPs or collaborates at tier 2 level. Through consultations during the course of pre-proposal development, we have identified a number of exciting research initiatives across other CRPs and look forward to fleshing out the modalities of collaboration during the full proposal development once the overall CRP framework has been confirmed.</i></p>
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<p>Budget allocations do not appear to be based on a reasoned priority setting on new opportunities, expected impact, or sequencing. In addition, an indication is required as to how much the expected levels of W1/2 funding are per FP (or whether these stand at the 50% indicated for the CRP), as opposed to reflecting bilateral funding on topics where donors have specific interest. In addition, consolidation of the apparent substantial overlaps between the 'Transformation and Scaling' FP and other FPs may provide opportunities for efficiency savings and free up resources that could be allocated elsewhere in the CRP.</p>	<p>Update: In line with donor guidance provided at the November Rome meeting and in the full proposal guidance, allocations of W1/2 funds are shown in relation to outcomes and (in each narrative) for the priority research areas.</p> <p><u>Previous:</u> As noted earlier by the reviewers, the CRP is not starting from scratch and is building on a large body of earlier and ongoing work. The reasoned allocation of budget is based primarily on a mix of the relative contribution of each FP to the overall agenda and the capacity assembled to address each area. We will add a statement to clarify this in the proposal.</p> <p>Allocation of W1/2 funding by FP was explicitly not requested in the Guidance document (<i>"Budget estimates are expected for each result at the pre-proposal stage, regardless of the source of funds: that is total costs, including W1-2 as well as W3-bilateral. Estimates by source of funds will be requested at the full proposal stage."</i> P. 49), so we would ask clarification why the ISPC expected this information</p>
<p>The funding requested for the management of the CRP is significantly higher than the management budget allocated to similar sized CRPs, and needs further clarification and/or revision.</p>	<p>Update: The management budget request has been described, including the key elements as described in the full proposal guidance.</p> <p><u>Previous:</u> ILRI will revisit the proposed management budget but requests confirmation from the ISPC about the expected constituent items within the Management line item e.g. impact assessments, evaluation, communications, open access, meta data analysis, M&E data collection, strategic investment for RBM, etc. We suspect that differing assumptions about the composition of the budget may be leading to variation across CRPs, as has been noted in various meetings.</p>
<p>5. Governance and management [Score: C]</p>	
<p>This is a new CRP, and hence a new governance, leadership and management structure will need to be established. The pre-proposal indicates that this CRP will be aligned to the best practices for management and governance that emerged from on-going CRPs as well as from reviews and lessons learned from the Livestock and Fish CRP. The CRP, however, is invited to carefully check the IEA review on CRP Management and Governance, as part of the proposed arrangements appear to run contrary to its observations on independence and legitimacy.</p>	<p>Update: CRP management and governance dimensions are articulated in line with the guidance note.</p> <p><u>Previous:</u> We ask ISPC for clarification on the specific parts that run contrary to the Guidance. A comparison of our proposed governance structures, which followed directly the Guidance, with those of other CRPs which the ISPC graded 'A' or 'B' does not reveal any significant differences. We did make some small adjustments in the management committee to reflect the preliminary feedback we had received from the L&F IEE on the positive aspects of our governance mechanisms, which we understand we were encouraged to take into account. It would be useful to know whether the ISPC had access to and considered input from the IEE team.</p>
<p>The proposal provides very limited indication of the criteria/ToRs for selection of the new CRP leader, which makes it difficult to assess the overall leadership of the CRP. The competencies of the FP leaders and other</p>	<p>Update: ToR for the CRP director and other management arrangements are described, in the overall management and governance section and for each flagship. Flagship leadership has</p>

<p>proposed staff include scientists with strong track records, mixed with some relatively unknown quantities. The proposed joint appointments of, at least, two FP leaders (genetics and health) is applauded, but will require significant additional attention to coordination and internal communication, and increase the leadership-related transaction costs.</p>	<p>been reviewed, and a competent senior team assembled to deliver the CRP working closely with partners.</p> <p><u>Previous:</u> There was no requirement in the pre-proposal guidelines to provide ToRs for the selection of the CRP Leader: we are happy to respond to this supplementary request, but consider the comment an unreasonable basis for judging the quality of the pre-proposal.</p> <p>We wish to clarify the joint appointment arrangements. Firstly the identified FP leader for animal health is not a joint appointment and nowhere in the pre-proposal is that stated. The FP leader for animal genetics is a joint appointee between ILRI and University of Nottingham, but who will be ‘seconded’ full time to ILRI so there are no additional transaction costs.</p> <p>We have reviewed the leadership for the indicated FPs and are proposing leaders with stronger track records: Steve Staal to lead the Livelihoods, Resilience & Nutrition FP and Tim Robinson to lead the Priority Setting & Impact at Scale FP. Their brief CVs were included in the annex to the original submission.</p>
<p>The current partnership presentation, rather than a specific strategy describes the comparative advantage of its various proposed science discovery partners. Whilst these seem to have strong international reputations and fill relevant gaps in comparative advantage, more information is required on the specific nature of the partnership arrangements, and how well institutional priorities align with those of the CGIAR and this CRP. National and regional AR4D partners get limited or no mention and should be identified.</p>	<p>Update: As above. The partnership sections and tables provide the information as indicated in the guidance notes.</p> <p><u>Previous:</u> Our partnership strategy is mainly based on understanding their comparative advantage and ability to contribute, so we would ask ISPC for clarification on what types of additional information is expected.</p> <p>The reviewers acknowledge that the pre-proposal followed the guidance provided to “indicate who the key strategic partners are and briefly describe their roles and added value”; the guidance did not ask for detailed information on the specific nature of partnership arrangements or an assessment of institutional alignment. We therefore do not consider the comment reasonable as a critique of what was expected in the preproposal, but consider it appropriate to address as a clarification in the full proposal. As clarification in the meantime, in the case of both academic partners, Wageningen UR and SLU, they both have explicit mission statements and units dedicated to positioning their research to contribute to the same basic development objectives as the CGIAR; GIZ, as a development agency, is also clearly aligned with the CGIAR objectives.</p> <p>As noted above, we have asked ISPC to clarify their expectations in terms of lists of the many national and regional partners versus the strategy of how they have been and will, in the future, be identified.</p>

<p>The selection of GIZ as the CRP's bespoke 'research into use' partner provides an interesting opportunity to explore how research products and expertise can be used productively for social and economic impact. To achieve this, however, its purpose should not just be to transfer technologies, but also to couple access to technology and expertise with access to markets, credit and other inputs, as well as the facilitation of the institutional arrangements that make such links responsive to the needs of stakeholders. The wide-ranging impacts from the lessons that have emerged from similar experiences (e.g. World Bank 2006; RIU, 2012; World Bank AIS source book) do not appear to have been adequately considered by the FP, and it is not evident that the proposed FP leadership has the appropriate profiles and institutional backing to effectively deal with them. There are additional questions whether this type of work would not be better approached at the System level.</p>	<p>Update: the role of GIZ in particular is articulated, and the agenda has been initially focused on the Livestock Feeds and Forages flagship, which is congruent with the engagement with GIZ in crop agri-food systems CRPs, thus further strengthening learning opportunities.</p> <p><u>Previous:</u> The preproposal tried to highlight the role of GIZ as a development partner interested in exploring how the research-development interface can be more effective in translating research outputs to impact in terms of development outcomes and at scale. GIZ will bring a development perspective to this research agenda; WUR will bring in a more academic view and ILRI and other partners will bring experience from a livestock angle. The pre-proposal has been misinterpreted to suggest that GIZ is the CRP's bespoke 'research into use' partner, whereas it explicitly cites collaboration with a range of local and international development partners, not just GIZ. The new Priority Setting & Impact at Scale FP will emphasize the research role of GIZ; the piloting and scaling of interventions have been shifted to the other FPs as recommended, and GIZ remains as a partner in the 'Science of Impact' cluster of activities within the Priority Setting & Impact at Scale FP.</p> <p>Similarly, we would ask clarification on what basis ISPC considers our approach to focus only on transferring technologies. Certainly the intent of the original formulation of the Transformation & Scaling FP was to develop integrated interventions that took into account the range of factors required to enable uptake of improved production and marketing systems. The Science of Impact activity will build on the references cited.</p> <p>Given the importance of understanding how research outputs can be promoted at scale beyond the CRP's sphere of influence, we are proposing to retain the 'Science of Impact' as a priority new research area. We do not see any evidence that this will be addressed at the System level in the near to medium future.</p>
<p>6.1 Animal Genetics FP [Score: B]</p>	
<p>The FP has good relevance to the SLOs, but the expected outcomes appear to be vague and overly ambitious. For example, the suggested 50% increase in productivity by 2.3 million smallholders from improved breeding in a 4 to 5 year period doesn't give any indication on commodity, species, or system. This would only be within the realms of possibility for poultry. It is thus recommended that this FP revisits its targets. Further clarification is also required on the envisaged roles and responsibilities of the suggested partners and whether, for example, the importation and introduction of exotic breeds is part of the FP. Understanding systems evolution is clearly essential, but the narrative on characterisation suggests a start from scratch, rather than an update of previous work.</p>	<p>Update: Targets have been updated and reorganized throughout the proposal in line with the guidance provided. An annex is included to explain the underlying methods and assumptions used.</p> <p><u>Previous:</u> The target of around 2.3 million households (not smallholders) in 2019 and 3.2 million household years in 2022 represents the total figure for mainly cattle and chickens for the main livestock commodities (milk, egg or meat) for the rainfed and irrigated mixed crop/livestock systems (humid and sub-humid, highland/temperate) in dairy cattle, and for the rainfed and irrigated mixed crop/livestock systems (arid and semi-arid, humid and sub-humid, highland/temperate) in chicken. [Note: we focus primarily on dairy cattle and chickens because W3 funding is secured to ensure these can be delivered; additional numbers can be estimated for small ruminants and pigs, but will be contingent on mobilizing the required resources.] We recognize that these are ambitious but our calculation indicated that they are</p>

	<p>achievable within the timeframe of the CRP. We are providing below the outcome of our calculation for chicken and dairy cattle at country level for these systems and commodities.</p> <table><tr><th colspan="2">Number of households</th><th>2019</th><th>2022</th></tr><tr><td>Dairy cattle</td><td>Ethiopia</td><td>592,213</td><td>888,320</td></tr><tr><td>Dairy cattle</td><td>Tanzania</td><td>192,946</td><td>289,418</td></tr><tr><td>Dairy cattle</td><td>Kenya</td><td>26,631</td><td>133,154</td></tr><tr><td>Chicken</td><td>Ethiopia</td><td>654,425</td><td>872,567</td></tr><tr><td>Chicken</td><td>Tanzania</td><td>312,172</td><td>416,230</td></tr><tr><td>Chicken</td><td>Nigeria</td><td>483,299</td><td>644,398</td></tr><tr><td colspan="2">Total</td><td>2261685.812</td><td>3244087.188</td></tr></table> <p>Also, it should be noted that the current yield gaps are so high and production levels so low, that with modest breeding management improvements, the fairly high rates of increase in production levels are achievable and realistic. For example where indigenous cattle are to be replaced by more productive but resilient crossbreds, improving milk yield from 1-2 litres/cow/day to 5-10 litres/cow/day is achievable, but the sustainable genetic component is indeed much lower 1-2%/year.</p> <p>This flagship is heavily building upon our understanding of agricultural systems evolution, which have led to the prioritization of the targets (small ruminants, dairy, and chickens). It is equally building on gained knowledge on the uniqueness of indigenous livestock breeds and intervention impacts from the Livestock & Fish CRP (e.g. pigs in Uganda and Vietnam, small ruminants in Ethiopia, Tanzania dairy cattle).</p>	Number of households		2019	2022	Dairy cattle	Ethiopia	592,213	888,320	Dairy cattle	Tanzania	192,946	289,418	Dairy cattle	Kenya	26,631	133,154	Chicken	Ethiopia	654,425	872,567	Chicken	Tanzania	312,172	416,230	Chicken	Nigeria	483,299	644,398	Total		2261685.812	3244087.188
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<p>The scientific quality appears to be of a high standard, making use of a comprehensive set of tools including recent advances in breeding research and strengthening comparative advantage through partnering with WUR and SLU, but it would strengthen the full proposal if the justification for the choice of these partners over other expert groups in these fields were to be included. Further clarity is required on how the current focus on breed development for specific local conditions, will deliver IPGs. The proposed reproductive technology platform appears to be an exception to that rule. In addition, consideration should be given as to whether closer cooperation with the commercial sector in the technology development phase could further improve the FP's comparative advantage. Cluster 4's focus on Policy and Institutional Support is welcomed, although it is not clear whether broader policy process issues have been adequately reflected in the research plans, including the key issue of public and private sector roles. The FP shows</p>	<p>Update: The partnership and ToC sections have been reworked to more clearly articulate different partnership arrangements and their roles. These are described at flagship level as well as in the relevant annex sections.</p> <p><u>Previous:</u> Our partnership scheme includes actors all along the value chain (academics and advance research partners, national, regional and international institutions, private and development partners...). For example, within the framework of the cluster “improved breeds of livestock for enhanced genetic gains” with main output the delivery of improved genetics (initially mainly crossbreds, indigenous zebu – exotic dairy), the partnership for dairy improvement embraces: advanced research institutes (SLU, WUR, University of New England - technology developments, design of genetic improvement program and genetic evaluation systems), PICO team East Africa (Institutional and Capacity development), Land O’ Lakes (NGO establishment of farmer cooperatives) working with private partner GENUS (artificial insemination company, delivery of improved semen and business plans), and National</p>																																

<p>commitment to training and gender, but it should clarify how this has affected its selection of research topics or priorities.</p>	<p>Agricultural Research and Delivery Institutions (Ethiopian Institute of Agricultural Research, Kenya Agricultural and Livestock Research Organization, Tanzania Livestock Research Institute, national artificial insemination centres of Ethiopia, Kenya and Tanzania); with the latter together with the private and NGO partners, taking leadership in the importation, introduction and delivery of improved dairy genetics (piloting and scaling targets) in line with national policies and livestock strategies as well as country endorsed international treaties. It is correct that there are other advanced research institutes in the areas of livestock genomics and breeding, but there are relatively few which have knowledge or research interest in tropical livestock systems. We have included most of those as research partners and we are proposing a stronger partnership with two institutions: Wageningen University (WUR) and the Swedish University of Agricultural Sciences (SLU). Besides the availability of relevant technical expertise, these stronger partnerships are building upon successful prior scientific and capacity development collaborations (SLU, WUR) and on the closest involvement of WUR in the design and now implementation (capacity development, breeding programs) of a window 3 BMGF funded chicken project of relevance to clusters 2 and 3 of the Animal Genetics flagship. SLU is also leading the Animal Health flagship, while the International Bull Evaluation Service (Interbull) a permanent sub-committee of the International Committee for Animal Recording(ICAR , an important delivery partner in cluster 3) is hosted at SLU and its director an SLU employee.</p> <p>In the majority of cases, breeds will need to be developed for local conditions, such that the needs and preferences of the low-input livestock keepers are met and to enable transition to more productive systems. However, IPGs will be developed from the lessons learned and development of new tools and approaches along the value chain. For example, the community-based breeding programs methodology developed in Ethiopia (during CRP1) is at the moment being applied in similar programs initiated in Uganda and Malawi by USDA. Also and more pragmatically, our crossbreeding program will capitalize on a restricted number of exotic breeds, initially designed for enhanced productivity in intensive production systems, using the experience gained to move these from the status of ‘LPG’ to ‘IPG’.</p> <p>Reference to the private sector is indeed a fair point, which will be fully taken on board in the full proposal. Under the business plan for delivery of the improved and desired genetics, the private sector (notably livestock genetics companies (exotic breed semen provider e.g. GENUS), farmer and/or breeder organizations) will be key partners in both the planned dairy and small ruminant improvement programs. In particular, it is anticipated that the private sector will be closely associated with the design and implementation of breeding schemes, the delivery of improved genotypes, the adaptation of existing reproductive technology to local situation, the identification at genome level of relevant mutations for genome editing leading to new genotypes.</p>
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	<p>As indicated in the pre-proposal, we aim to support national partners in the development of policy guidelines on AnGR use, and the provision of platforms and systems supporting livestock genetic improvement. This will be done in partnerships with key national stakeholders including agencies and ministries responsible for livestock development, such as AU-IBAR and FAO Animal Production and Health Division, and in alignment with national livestock development strategies, which specify the key issues of the public and private sector roles. Indeed discussions are already underway on how these partnerships will be operationalized.</p> <p>Research topics and priorities were chosen taking into consideration the training needs, which accordingly are being included in the clusters of activities with inclusion of relevant partnerships (e.g. Pico Team East Africa, academic institutions). By design, the proposed activities will be participatory, thus stakeholders will be continuously engaged, and by so doing any training or capacity development needs will be duly captured and solutions to such constraints co-created and addressed accordingly.</p> <p>The focus on dairy, small ruminant, pig and chicken improvement is strategic. Livestock commodities such as milk are available on a daily basis tackling poverty and nutrition issues, affecting the entire household but in particular children and women. Both poultry and pigs are often household enterprises where women are key decision makers and control use of the benefits (and benefits in the hands of women are more likely to be spent on household food and nutritional security, and children's education etc. than benefits in the hands of men).</p>
6.2 Animal Health FP. [Score: B]	
The work aims to align with national and regional priorities and initiatives, but there is no clear strategy on how this will be achieved. As such, whilst the strategic relevance of the work is clear, the ToC and impact pathways require significant additional attention.	<p>Update: Flagship ToC and impact pathway narrative and diagram has been reworked. Partnership sections also updated</p> <p><u>Previous:</u> In order to align work with national and regional priorities, the Animal Health FP will continue ongoing collaborations and discussions with AU-IBAR, OIE, and FAO regional control programs and support the animal health elements in ongoing national Livestock strategies (e.g. Livestock Master Plans in Ethiopia). The impact pathways and ToC will be revised to more clearly reflect how the flagship aims to achieve its intended outcomes and include the elements "risks" and "assumptions".</p>
The current narrative indicates that vaccines and diagnostic tools will be developed, but is less clear on the key diseases and specific diagnostic tools it aims to deliver, unless this is expected to wait until the outcomes of the characterisation work are available. In that respect, whilst it is appreciated that risks are changing and that these require constant updating, the proposed work on measuring disease burdens and socio-economic impacts	<p>Update: Greater specificity is provided on the diseases, rationale and the broader approach for herd health that will build on results of others beyond the CRP and its predecessor.</p> <p><u>Previous:</u> The FP intends to continue ongoing vaccine work on identified key diseases, incl. East Coast fever, <i>Peste des Petits Ruminants</i> (PPR), Contagious bovine pleuropneumonia (CBPP) and Contagious caprine pleuro-pneumonia (CCPP), and African swine fever, diseases</p>

<p>should build on the long history of research in this area, which currently is not apparent. The full proposal should be clearer on priority diseases and why they have been selected as such.</p>	<p>which are identified as having significant impact on the target beneficiaries of the CRP, for which considerable capacity already exists and for which there is limited private sector investment. In addition disease constraints identified in cluster 1 will be added if deemed appropriate. Similarly for the diagnostic platform, ongoing work on point of care (POC) tests, such as for example CBPP, will continue, but work will also focus on disease constraints identified in cluster 1 in order to ensure that fast and cost-effective diagnostic tools are available to strengthen on farm diagnostics and national surveillance programs. These points will be explained in more detail in the full proposal with more reasoning around the development of assessment tools and metrics for impacts and how existing knowledge will be included in these analyses.</p>
<p>The FP will use novel tools and techniques to accelerate vaccine discovery and product development, but whilst lessons learned from previous work are said to have shaped the proposal, there is limited actual information on the results of similar work under L&F. Most of the candidate diseases are so-called "orphan diseases" that require international public support, and to which the FP will bring its combined expertise on vaccines and diagnostics (from the discovery phase to proof-of-principle both in the laboratory and the field). Its leadership team –to be led by a non-CGIAR partner from academia- have a strong track record. Science partners have been well-chosen and bring additional skills and expertise, but national and regional science and development partners need more attention and inclusion. Based on the targeted disease, other partnerships –including with the private sector– will need to be developed and the distinct lack of development partners needs to be rectified.</p>	<p>Update: Partnership arrangements are updated and described in the flagship and CRP sections, as well as in the flagship ToC.</p> <p><u>Previous:</u> We recognize that more explicit/detailed information about the positive and negative lessons learnt in the L&F CRP needs to be provided in the full proposal. We will also provide information about selected national and regional partnerships, including those focused on private sector partners, especially GALVmed with whom we are already working and companies who have expressed interest in partnering with us, especially to scale out new technologies.</p> <p>We anticipated more detail on the many national level partners would be appropriate in the full proposal and site integration plans.</p>
<p>The proposal is not clear on how the need for an enabling environment has been conceptualized as part of its research activities, and CapDev and gender are mentioned in passing only. The candidate list of ‘selected’ diseases, however, does include those considered to be of particular importance to women. The FP does not elaborate in-depth on the need for research to account for potential unintended consequences on SLOs that are not its primary focus. The proposed budgetary split among clusters appears to be appropriate</p>	<p>Update: the integral importance of CapDev, gender as well as new opportunities for youth are articulated.</p> <p><u>Previous:</u> We agree that this could have been better developed in the pre-proposal. There are several critical policy elements that must be addressed in the full proposal such as those related to delivery of animal health services and use of antimicrobials. The “in passing only” for CapDev and gender was a matter of integrating/streamlining these aspects rather than to have them presented separately. This will be altered in the full proposal to be more explicit how gender is integrated into research, especially in clusters 1, 2, and 4, and to provide a detailed outline of capacity development activities in each cluster. . We will further elaborate on “the disease-list” with a gender perspective. Our initial assessment of potential unintended consequences related primarily to increasing animal numbers in areas where production has been constrained by disease: we see these as being addressed by the systems analysis-based work in the Priority Setting & Scaling FP which allows a sector-wide perspective. We will also put emphasis on assessment of potential positive unintended consequences.</p>

6.3 Feeds and Forages FP. [Score: C]	
<p>This FP intends to follow a demand-driven approach, informed by value chain analysis and stakeholder consultations conducted in CRP priority locations. The FP aims to contribute to sub-IDs on closing yield gaps and the more efficient use of inputs. In collaboration with the L&E FP it will address sub-IDs on reduced greenhouse gas emissions and increased resilience of agro-ecosystems and communities, while its work with the Resilience, Nutrition and Livelihood FP aims to contribute to the sub-IDO on increased livelihood opportunities. In this respect, work on feeds and fodder should be of high strategic relevance. The ToC of the FP, however, is not convincing and is particularly vague on socio-economic constraints. In addition, the suggested product lines and impact pathways are unlikely to add up to the highly ambitious target outcomes.</p> <p>Summary recommendations: Revisit ToC and impact pathways</p>	<p>Update: The flagship has been reworked, to be more focused and organized more tightly around four clusters of activities. The focus is on the feed and forage technology dimensions and the interface with livestock and the environment is articulated. ToC sections have been updated.</p> <p><u>Previous:</u> We will revisit ToC, impact pathways and sub-IDs focusing on technology development and testing. Adopting a similar flagship structure with the other technology FPs (Animal health and Animal Genetics) will allow a better definition of the demands and constraints and also will define better links and distinctions to the other flagships in the CRP – i.e. Priority Setting & Scaling, Livelihoods, and Livestock and the Environment (see also below on revised cluster structure) - and cross-CRP linkages.</p> <p>We recognize that we need to revise product lines and impact pathways to reach target outcomes. However, in several cases the product lines have documented figures on the path to the stated outcomes which we will attempt to clarify</p>
<p>The Feeds and Forage FP builds on decades of forage, feed and rangeland research, and whilst the comparative advantage should be high, this is not apparent from the proposal. As a result, it is difficult to assess its scientific quality. Excellent work has been carried out in the CGIAR, including the development of new tools, but it is not evident how the lessons and novel approaches have been conceptualized and integrated into a convincing research agenda. The scientific team is strong on animal nutrition, but seems to lack skills in the area of the ‘full purpose crop concept’, which is at the heart of the FP. Moreover, the rationale for the withdrawal from other CRPs is noted, but in line with the recommendations of the ISPC’s Strategic Review of Livestock in the CGIAR, some mechanism will need to be in place to ensure the integration of feed research among CRPs. There should also be additional reflection whether this work could be more effective using a systems lens, rather than the current country-related focus only. In that respect, whilst the FP lists existing and desired partners, there is no clear networking or partnership strategy on how the research outputs from the specified countries will be utilised to maximize the IPG benefits across other countries and regions, nor are details on site integration with other CRPs presented.</p> <p>Summary recommendations:</p> <ul style="list-style-type: none"> • Clarify research focus and agenda; • Revisit country vs. system focus; • Clarify networking and partnership strategy for delivery of IPGs 	<p>Update: The conceptualization and articulation of the research agenda have been reworked to be more focused and better stated. Clusters have been rearranged as indicated below.</p> <p><u>Previous:</u> We will update lessons learned with representative examples and references and strengthen description of the comparative advantages; recognizing the state of the art expertise of flagship participants and partners.</p> <p>This will include a better conceptualization of the research agenda, leading to the identification, development and delivery of novel products and approaches as linked to technology development.</p> <p>We request clarification of the reviewers’ comments on withdrawal from other CRPs and the lack of skills in the ‘full purpose concept.’ The flagship in our view is particularly strong on cross-CRP linkages as for example there are two specific cross-CRP initiatives listed, a) on the full purpose crop approach and b) on Biological Nitrification Inhibition. These initiatives are cross referenced in the respective Agrifood CRPs. We tried to already illustrate this in the cross-CRP integration table in the annex which the reviewers may have missed.</p> <p>One the reviewers thought that the team ‘lack skills in the area of the ‘full purpose crop concept’ we do not agree since ILRI in particular has been at the forefront of this research for over 10 years and has had some remarkable successes in this area influencing both national and CGIAR crop improvement programs. For example in India the release system for new</p>

	<p>sorghum varieties now includes data on nutritive value of stover. Several existing CRPs (Maize, Dryland Cereals, RTB) include research on improving feeding value of crop residues in their programs.</p> <p>At the heart of the flagship is technology development identifying new options and making use of these.</p> <p>The revised cluster structure would have four clusters, briefly:</p> <ol style="list-style-type: none"> 1. Assessment and diagnosis of Feed constraints and opportunities 2. Development of new feed and forage options 3. Better use of existing and new feed resources 4. Delivering feed and forage technologies <p>We will aim to further distinguish the Feeds and Forages Flagship from the more system oriented flagships and in this context clarify geographical and systems focus (which are however interrelated) , partnerships and impact pathways</p>
<p>This FP acknowledges the importance of the enabling environment, which the proposers relate to the capacity for technology development, knowledge sharing, delivery partnerships (including public-private engagements), and infrastructure such as laboratory facilities, but there is no evidence in the narrative as to how this appreciation has impacted on the research agenda. CapDev-related training activities in the FP are said to build on approaches that are used by L&F, although there is no indication of previous results and how lessons learned have been incorporated. The FP appears to spend much time on gender analysis, but it is less clear how this influences its research questions. The proposers do not develop further the need for research to account for potential unintended consequences on SLOs that are not its primary focus. The proposed budgetary split among clusters appears to be appropriate. In light of the above comments, a major rewrite is required for this FP, in which merging with the L&E FP should be considered.</p> <p>Summary recommendations: Consider merger with FP4 – major rewrite required</p>	<p>Update: CapDev and gender dimensions are much more integral to the research agenda and its delivery ambitions. There has been considerable reworking of the flagship proposal. Merger with the Livestock and the Environment flagship has not been undertaken as described above.</p> <p><u>Previous:</u> We will revise the section related to the enabling environment according to the revised cluster structure focusing on technology development and delivery.</p> <p>This will include the influence of gender on prioritization of the research questions, CapDev lessons (e.g. building on the successful development and support for the use of near infrared spectroscopy across a network of national labs and the use of tools to prioritize feed interventions by research and development agencies) and clarifying the ToC/Impact pathway including relation to the SLOS.</p> <p>As stated above we are not convinced of the merger with FP4. However we will address in this flagship unintended consequences as can be mitigated through technology development (e.g. stress tolerance of feed/forage options, Biological Nitrification Inhibition) and, as well, through analysis of potential trade-offs (environmental impacts, land competition for food crops, etc.) led by the Priority Setting & Scaling FP.</p>

6.4 Livestock and the Environment FP [Score: C]	
<p>This is a crowded field, however, with many other major players. The FP and its ToC, do not show an appreciation of the vast amount of work that is going on in this area. As a result the proposed activities (both on the science discovery and application side) appear to overlap significantly with work being undertaken by other organizations. The list of product lines in Cluster 2 makes interesting reading, but it is not clear whether these should be viewed as examples of possible research topics, or whether these issues have been selected on the basis of discussion with key stakeholders and/or ongoing analysis? Such consultation and analysis with key stakeholders including the FAO, CSIRO, GRA, and the CCAC and country partners, however, is exactly what will be required to be able to propose a value-added, focussed and novel research agenda that contributes to the achievement of SLO 3.</p> <p>Summary recommendations:</p> <ul style="list-style-type: none"> • Revisit ToC and impact pathways; • Clarify research focus and agenda in consultation with partners; 	<p>Update: A tighter agenda and rationale for the flagship are presented, stressing the particular role of this area of work, its unique niche and relationships to the many others engaged in pieces of work related to the overall livestock and the environment agenda. The ToC has likewise been strengthened. Further notes on the retention of this flagship are provided above.</p> <p><u>Previous:</u> The TOC will be revised to more specifically address the key problems the flagship aims to address, namely reducing the environmental footprint of livestock production, enhancing their role in providing key ecosystem services, and ensuring sustainable production in the face of ongoing global environmental change. This will include articulation of key research questions and testable hypotheses, for example: In which contexts can productivity be increased without increasing the environmental footprint of livestock, and by how much? The outputs from the Cluster activities will be specifically linked to the TOC.</p> <p>We acknowledge the remark that research on Livestock and the Environment is a “crowded field”. However we feel that the CGIAR has a specific role to play in ground-truthing much of the global analysis that other partners are conducting, for example in relation to measurements of GHG emissions from livestock systems (where virtually no research has been carried out in Africa, for example) or ecosystem services such as biodiversity or disease regulation provided by livestock systems. Similarly we can link to many national partners in terms of raising the profile of environmental issues and supporting capacity development. We are currently conducting a dialogue with the broader scientific community to validate our current Livestock and Environment research agenda, and more clearly define our niche. This dialogue will end in late December, in good time to inform the full proposal development for the Livestock CRP. Finally the inclusion of a flagship specifically focused on environmental issues is partly in response to repeated comments, including in the ISPC White Paper on livestock in the CGIAR that the current Livestock and Fish CRP did not have an explicit focus on environmental issues.</p> <p>In the revisions we will more clearly articulate the specific niche of the FP in the admittedly broad Livestock and Environment field. We will also describe our current collaborations and consultations, many of which have indeed been used to guide the development of the FP research priorities, which focus on finding context-specific solutions for developing country livestock systems. We will also give more space to articulating the strong synergies between this FP agenda and those of the relevant FPs in the WLE and CCAflagship CRPs (which are</p>

	<p>detailed already in an Annex). The FP includes a section on these linkages, especially with the Climate Change CRP. The discussions with these two CRPs in particular have guided the research agenda for the Environment flagship. For example, CCAflagship FP 3, WLE and the Environment FP of Livestock CRP all aim to reduce land degradation; increased carbon sequestration in livestock forage/ grazing systems could be a co-benefit of these efforts. The Environment FP of Livestock includes specific research interventions to reduce degradation in pastures and mixed livestock-crop systems, as well as research on using improved forages; the possibilities for reducing GHG emissions from these systems will be explored here, and reported to CCAflagship</p>
<p>The information provided in the narrative is not sufficient to assess the scientific quality of the FP, however, the proposed FP leadership seems appropriate and there are some strong team members with good track records in this area of research. Whilst it is appreciated that this FP intends to embrace the <i>One Health</i> approach, clarification is needed on how this has been conceptualised towards its integration in the proposed research</p>	<p>Update: More detail and a more focused agenda, articulated in relation to the overall CRP conceptualization of priority trajectories is presented. The one health agenda is not prioritized at this stage, given the need to focus.</p> <p><u>Previous:</u> To better demonstrate the scientific quality, we will provide more specific detail on the activities to be conducted, and how they build upon the expertise of the proposed team members.</p> <p>We will provide more detail on how the One Health approach will inform the proposed activities. Our experience with the One Health approach is that this has been used more to understand human and animal health, neglecting the importance of environmental health to ensure human and livestock health. Through collecting better ground-level data from a range of specific production systems and contexts, this flagship will strengthen recommendations for managing agro-ecosystems to contribute to improved livestock and human health.</p>
<p>This FP aims to include women and youth as agents of change in environmental management, although there is no explanation as to how this will be achieved. It acknowledges the importance of the enabling environment, particularly in getting the right mix of regulations and incentives through its links with national governments. How this is reflected in the proposed activities, however, is not evident. The FP also recognizes the need for capacity development for multiple partners to ensure its sustainability, but provides little detail on what will actually be done.</p>	<p>Update: Engaging women and young people as well as capacity development are central to the flagship ToC and delivery of its ambitions and these have been articulated.</p> <p><u>Previous:</u> We will provide more details on how we will engage women and youth as agents of change in the cluster of activity descriptions. Given the goal of increasing women and youth's access to and control over resources, the flagship will focus first on understanding the differential roles of women, men and youth with respect to environmental management through the research in Clusters 1 and 2. Under the activities in Cluster 3, the flagship will seek to promote and enable women and youth to have more active roles in decision making, governance bodies at the local level, and as change agents.</p> <p>We request clarification on the comment on the enabling environment, given that the FP has an entire cluster focused specifically on those issues. Perhaps we need to better articulate the</p>

	purpose of Cluster 3 to make this clearer. The title may have been misleading, but the intent is to provide national and local level support in the focal countries to institutions, governance mechanisms and policies necessary to ensure good environmental management of livestock production systems.
<p>The equal division of proposed budgetary resources among outcomes appears to confirm the lack of thorough priority setting. In light of the above comments, a major rewrite is required for this FP, in which merging with the F&F FP should be considered.</p> <p>Summary recommendations:</p> <ul style="list-style-type: none"> • Revisit budgetary allocations; • Consider merger with FP3 – major rewrite required 	<p>Update: Budget allocations are completely revised, also taking account of priority topics and the allocation of W1/2 resources.</p> <p><u>Previous:</u> We will rethink the level of effort required in line with these comments, and suggest a more thoughtful priority setting. The ongoing consultation with key stakeholders will also help with priority setting. We also note that the clusters for this FP will be redesigned, in line with the conversion of the Transformation & Scaling FP to one focused on Priority Setting & Scaling.</p> <p>As already noted, we disagree with the recommendation to merge with FP 3.</p>
6.5 Livelihoods, Resilience and Nutrition FP. [Score: C]	
<p>The issues touched upon by the FP are clearly of strategic relevance, but the three clusters don't seem to deliver a coherent whole. As a result, the TOC and activities are relatively vague and unfocussed, with limited clarity on how the main product lines will add up to the target outcomes. The focus of the work seems to be on pushing potential solutions rather than on trying to identify a range of appropriate solutions for a specific context, or to develop appropriate tools for such purposes. The use of a value chain approach with a possible focus on systems in marginal areas with few alternatives to livestock might have provided a sharper set of research questions and enhanced the relevance of the work towards the achievement of the sub-IDOs.</p> <p>Summary recommendations:</p> <ul style="list-style-type: none"> • Revisit ToC and impact pathways; • Clarify research focus and consider alternative approaches; 	<p>Update: the CRP flagship structure has been revised, meaning the Livestock Livelihoods and Agri-Food systems flagship covers some elements of the previously described flagship as well as addressing prioritization and targeting elements. The conceptualization of the roles of livestock and opportunities to integrate research solutions from across the CRP portfolio and beyond form the basis for the research portfolio of this flagship which seeks to maximize livestock related livelihoods, equity, nutrition and resilience.</p> <p><u>Note: further comments on this flagship and the next are not addressed as part of the 'update' given that the flagship structure has been re conceptualized.</u></p> <p><u>Previous:</u> We agree that the ToC is not sufficiently clear and that the clusters did not add up to a coherent whole and that there are significant overlaps with originally proposed Transformation & Scaling FP. In order to address these issues, the Livelihoods, Resilience and Nutrition FP is being restructured around 4 clusters of activities and relevant components from the earlier Transformation & Scaling FP are being incorporated to achieve a more coherent program ToC. The main thrust of the first cluster will not be changed as it addresses core research questions on how to increase access of the poor to, and consumption of, safe and affordable ASF products in both rural and urban areas in an equitable way and thereby utilize the potential of increasing consumption of ASF to fight malnutrition. There are also important gender and intra household allocation considerations regarding consumption and also more broadly regarding inclusiveness in value chain and livestock production systems that require coordinated research on gender: therefore a cluster on gender and social equity</p>

	<p>will be added. The third cluster is about mechanisms to increase livelihoods and resilience options of smallholder livestock keepers and pastoralists through testing integrated technology packages and institutional innovations such as the Index-based Livestock Insurance (IBLI) concept with a system perspective in selected pastoral and crop-livestock farming systems. The fourth cluster takes a value chain perspective for improving value chain performance through more inclusive and sustainable mechanisms specifically targeting increased productivity and efficiency of livestock production and marketing, required to achieve increased ASF availability and ultimately better nutrition as stated in the first cluster. A revised impact pathway will show the linkages between the four clusters for achieving the FP outcomes and their contribution to specific sub-IDOs.</p>
<p>Whilst the FP's comparative advantage should be high, this is not apparent from the proposal. In addition, there seems to be potential for significant overlap with the FP on Transformation and Scaling in general, and with the other FPs on gender-related activities. In addition, work on the contribution of animal source foods to nutrition should be implemented jointly with the FISH and A4NH CRPs. The FP includes some strong team members with good track records in component parts of the proposed research, but there are questions as to whether the quality of the proposed FP leadership would be best used for the currently proposed activities.</p>	<p>The CRP partners have a strong comparative advantage in conducting research on on-farm competitiveness, value chain performance, gender and policy in relation to livestock building on expertise and previous work. We have a good track record in smallholders' participation in value chains as well as policy related work on value chain performance (cluster 4), institutional arrangements to increase livestock keepers resilience to climatic shocks with the weather Index based livestock insurance (cluster 3); strategic and integrated gender research work (cluster 2); We are increasingly building our expertise in nutrition related work (cluster 1), and we totally agree that this should be done jointly with A4NH and discussions are ongoing on this.</p> <p>Given the new structure of this flagship as well as the reformulation of the Transformation & Scaling FP to one on Priority Setting & Scaling, the risk of overlap is much reduced, even though by design, the 2 FPs will be coordinating efforts for scaling out proven interventions. As for gender, the strategy followed by the Livestock CRP is to follow a double path: first, gender research is integrated, or mainstreamed, wherever relevant in the other flagship; secondly, to ensure consistency and lessons learned with a system perspective, the gender work, both strategic and integrated, is an integral part of this flagship.</p>
<p>The FP contains some good discussion of the role of women in livestock systems and the relevant enabling environment. There is less discussion, however, on the implications this has for the research agenda. The FP's partnership strategy and choice of partners does not seem to have received the appropriate attention thus far. In addition, the potential unintended consequences of the planned research have not been considered in any detail. The challenge is thus not only to better define this FP's research in a way that fits the CGIAR agenda, but also to include a strategy to link local level partnership to groupings that have legitimacy and carriage for policy and institutional change at higher scales.</p>	<p>The L&F CRP and its partners have embarked in the last 12 months on a process to better integrate gender, including in the technical research. This process has resulted in refining the research agenda e.g. in the animal health delivery systems, given the differentiated role played by men and women in diagnosing diseases and making decisions on treatment. This progress hasn't been sufficiently articulated in the pre proposal. The revised document will articulate better how the gendered priorities identified in phase 1 inform the research priorities of phase 2. Phase 1 also identified the need to more systematically assess gendered priorities in the CRP's sites and develop mechanisms to integrate them in the research</p>
<p>Summary recommendations: Develop a clear partnership strategy in light of</p>	

policy and institutional change at higher scales	<p>agenda. This learning will inform the gender research strategy developed in the pre-proposal. More details are provided in the gender cross cutting section.</p> <p>The partnership strategy and choice of partners will be better articulated through the design of a FP impact pathway and a revised program ToC, indicating partners and stakeholders that need to be considered to influence. Assumptions will be articulated, including ‘killer assumptions’ that may jeopardize research and development outcomes need to be monitored regularly to identify mitigating interventions. The ToC will also include actors like decision and policy makers, both local and regional. ILRI has a strong track record in influencing policy level at higher levels, for example, in developing the Livestock Master Plan in Ethiopia and efforts to contribute to both the Tanzania and Rwanda livestock plan in progress.</p> <p>The ToC will also be used to identify the potential unintended consequences, which were not sufficiently addressed in the pre proposal, also due to space limits.</p>
<p>The budget seems high for what is likely to be delivered. The proposed allocation for the delivery of outcomes seems arbitrary and not based on any reasoned analysis or allocation of priority.</p> <p>Summary recommendations: Revise budget;</p>	<p>The budget will be revised as well as the targets.</p>
<p>Summary recommendations: Consider merger of indicated component parts with other FPs – major rewrite required</p>	<p>This has been addressed by the proposed new structure of this FP and the new Priority Setting & Scaling FP.</p>
6.6 Transformation and scaling FP [Score: D]	
<p>Impact at scale is obviously essential for delivery of the SLOs, but it is not apparent how the proposed FP would deliver the CRP’s added-value. In its current form, it appears to duplicate many of the systems analysis, testing, and gender analysis functions already present in the other FPs. Like the previous FP a focus on value chains might have been more appropriate. As such, due consideration should be given to the integration of the appropriate component parts into other FPs.</p> <p>Summary recommendations: [from 6.5 – assume it was meant for here] ☑ Consider merger of indicated component parts with other FPs – major rewrite required</p>	<p>We acknowledge that this flagship is rather experimental and that we had not articulated its role convincingly. We tried to emphasize that the FP is for research to support delivery, and not delivery as such. This included highlighting that GIZ was chosen as our strategic development partner because of their interest in experimenting on how research works with development within AR4D, and contributing to our work on the ‘science of impact. So the ISPC comment that the FP is “skewed towards disseminating supply-side science delivered by the other FPs through one preferred ‘development’ partner, rather than about experimenting with different ways of using research and partnership for impact” was exactly opposite to our intention.</p> <p>We agree, that the design of integrated innovation packages for delivering development outcomes is better achieved within the other FPs and so have shifted this work to the three technological and two systems FPs.</p>

	<p>There is still a need, however, to address the overarching agenda on priority setting that relies not only on systems analysis and impact assessment approaches, but also on an understanding of what kinds of research outputs can achieve impact at scale. Monitoring of the ToC considers the more fundamental challenges in translating livestock research outputs into development outcomes. A new FP is proposed on Priority Setting & Impact at Scale. The cross-cutting systems analysis work is housed here, recognizing its role in prioritization and assessing synergies, trade-offs and unintended consequences across the different components of livestock systems.</p>
<p>The partnership arrangements proposed in this FP are potentially interesting, but they seem to be skewed towards disseminating supply-side science delivered by the other FPs, rather than about experimenting with different ways of using research and partnership for impact. In their currently proposed form, impacts are likely to remain local and restricted to project cycle funding only. In the absence of attention to link these activities to higher-level initiatives or groups, the scope of addressing overarching policy and institutional constraints, or of alignment with longer term (and wider-scale) development goals and plans, remains limited. The current narrative does not indicate that such issues have been adequately considered. It is also not clear whether the proposed FP leadership has the appropriate profiles and the necessary institutional backing, and whether this type of work would not be better approached at the System level.</p>	<p>The partnership arrangements have been adjusted and ILRI proposes to lead this FP but with contributions from other CGIAR Centres and the development partner (GIZ) and academia (WUR) in the cluster that will explore different ways of using research and partnership for impact and scaling. It is important to note the close linkages between the priority setting cluster and the science of impact cluster. Potential for impact will be an important component of setting priorities and that will help shape the research agenda of the technological and systems FPs, ensuring that research outputs are translated into development outcomes.</p>
<p>As indicated, one of the FP's clusters deals with gender analysis and enhancing the role of youth. The FP acknowledges the enabling environment and commits to capacity development by enhancing the institutional capacity of partner research organizations, and will increase innovation capacity for partner development organizations and in poor and vulnerable communities, although no indications on how this will be achieved are presented. The budget is high but this is assumed to relate to the bi-lateral funding expected through the GIZ partnership.</p>	<p>No longer relevant.</p>